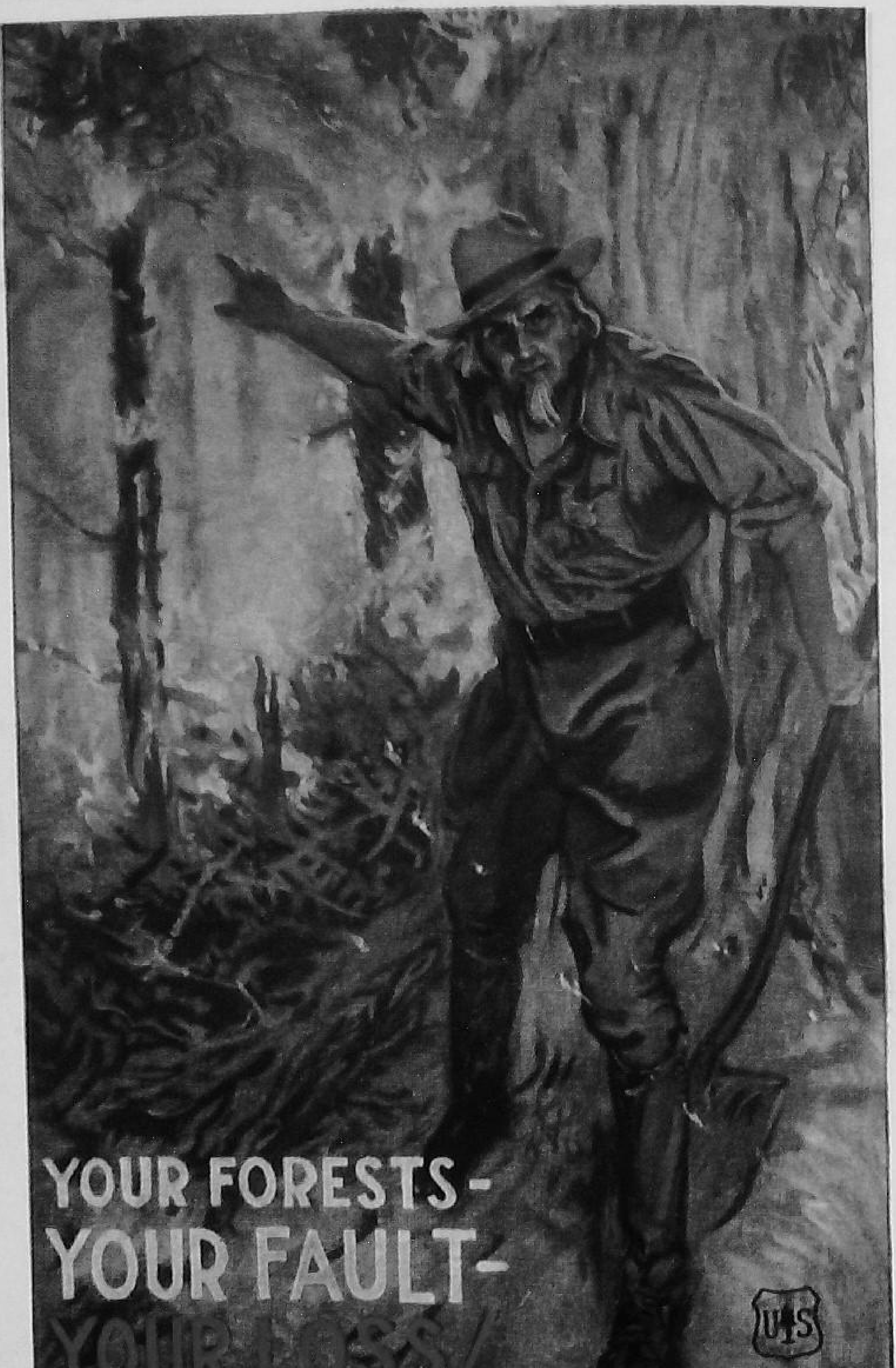
Southern FORESTRY

UNITED STATES OF AMERICA


YOUR FORESTS-
YOUR FAULT-
YOUR LOSS!
US

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SOUTHERN FORESTRY

By

Charles N. Elliott

and

M. D. Mobley

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FOREWORD

THE writing of this book was inspired by an interesting experience of the authors.

To encourage a study of forestry in schools, the Georgia Forestry Association offered prizes to farm boys for conducting forestry projects. Winners were given free trips to summer camps where the teaching of forestry was combined with a program of recreation.

At these camps which were located in forested areas, the authors—Charles N. Elliott, a professional forester, and M. D. Mobley, a professional educator—served as instructors.

Teaching in these summer camps, the authors developed instructional materials which were used over a period of several years. In this way they learned what aspects of forestry have the greatest value and interest-appeal to youth. They also learned how to organize and present this subject matter. This book contains the tested material produced through actual teaching experiences.

This book will meet the needs of teachers in the public schools who wish to include resource-use units in their teaching programs. Numerous stories told in this book will appeal to boys and girls and to men and women as well. It will also serve as a text or reference in *Farm Forestry*, as presented by teachers of vocational agriculture or instructors in the Veterans Farm Training Program.

Special Features

It may be noted by consulting the *Table of Contents* that the book contains a *glossary*. This is, of course, a dictionary of forest words, which should be used as the book is read and studied.

Suggestions For Study are given at the end of each chapter.

These include: (1) *Questions and Problems* for group discussion; (2) *Selected References;* and (3) *Suggested Activities.*

From 10 to 30 questions and problems are included for each chapter. These are merely suggestive; teachers will wish to multiply the number many times. Nothing will add to pupil interest so much as complete discussion of the context and related references.

The references listed are, for the most part, readily available. They may be secured, without cost, from state departments of forestry and from the United States Department of Agriculture. Federal publications may, as a rule, be secured through requests addressed to members of congress.

Teachers of vocational agriculture will find very helpful Bulletin 169, *Analysis of Special Jobs in Farm Forestry*, published by the U. S. Office of Education, Washington, D. C.

It should be noted by teachers that the *Suggested Activities* are of two kinds: Those designed for persons interested only in developing an appreciation of forest practices; those of concern to the owners and managers of woodlands. The second group may, if time permits, carry out all the activities; the first group will wish to select only those designed to give a broader knowledge of efficient forest policies and practices.

ACKNOWLEDGMENTS

State departments of forestry have generously submitted material that has been incorporated in the text. Facts and pictures have been contributed by other state conservation agencies, including state park and wildlife services. The U. S. Forest Service has supplied both material and illustrations, as has the Soil Conservation Service. Many pictures, especially those dealing with forest industries, have been furnished by industrial corporations. Quotations from several books and bulletins have been used. To these agencies and their representatives, the authors and editor wish to express their thanks and appreciation.

PAUL W. CHAPMAN, Editor

INTRODUCTION

THE IMPORTANCE OF OUR SOUTHERN FORESTS

WITHIN the boundaries of those states lying between Maryland and New Mexico are more than a *quarter of a billion* acres of forest land. In variety and composition they range from the typically northern forest of balsam, fir and spruce along the high crest of the Great Smoky Mountains to the deep swamp woods of cypress, gum and magnolia, bedecked in streamers of gray spanish moss. Between those two extremes are the hardwood forests, marching down the slopes of the Appalachians, and the wide pine barrens of the Coastal Plain. There are mixed stands and pure stands, seedlings and second growth, and here and there a pocket of hoary, virgin trees that time and the sawmills have passed by.

Since our national and state forests cover vast tracts throughout the length and breadth of this region, it is sometimes assumed that most of our forested land is publicly owned. Actually, less than seven per cent of this amazing woodland is owned and administered by the state and federal forest services. On the other ninety-three per cent, private forestry has, within recent years, developed into big business in the South.

Southern forests produce a variety of products. Out of the mountains, swamps and pinelands roll lumber, crossties, poles, pulpwood, naval stores and many other

raw and manufactured materials. From farm forests, plantations and commercial timberlands they come, giving employment to almost 750,000 men, returning to the farmer, landowner and manufacturer more than one billion dollars a year.

It is estimated that farm woodlands in the South make up two-fifths, or about 100,000,000 acres, of the total forest area. Since these are the lands which have been mismanaged through ignorance or neglect in the past, most state forest departments and services are at present giving them careful attention. They have come to realize that the proper management of so large an acreage as these woodlots total is of vital importance to the wood-using industries. They are hammering home to the farmer that his trees, handled as a crop, can be made an appreciable part of the farm income.

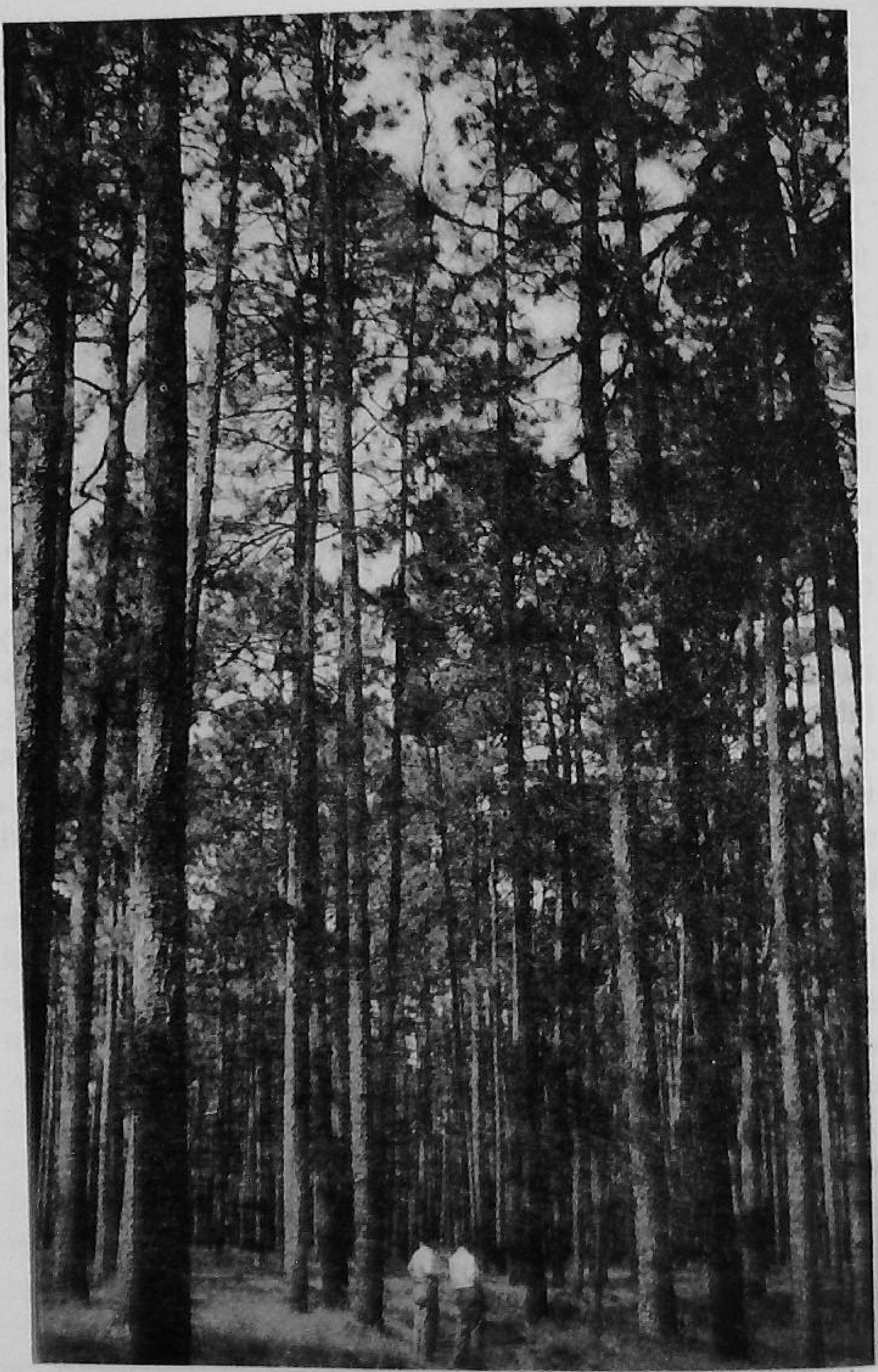
Forest industries are moving southward from every section of the United States. There are many reasons for this trend. One is that more than 50 per cent of all southern land is devoted to growing trees. Others are the fast rate of tree growth, the almost unbelievable variety of species, improved transportation facilities. Those are a few of the advantages the wood-using industries find in the southern states; they explain why the woodlot is growing more valuable year by year.

State forestry departments, knowing the contribution of the farm woodlands and other smaller forested tracts to the health, wealth and welfare of a community, encourage owners of forested land to call upon them for help and advice in the management of their trees. In every southern state where the owner needs such assistance, the department sends a trained forester to help him work out a program of fire control, thinning, marketing and other practices which will improve his stand and increase the income from it over a period of years.

Wood and its products, however, are not the only values that forests provide for the comfort and pleasure of man. In other ways they are important to every individual, whether or not he owns a forest or a single tree. There are many reasons why trees and tree communities play an essential role in our lives. They protect the watersheds and give us clean, sweet streams to provide us with water and many forms of recreation. They control temperatures, rainfall, and to a large degree, the climate of an area. They harbor many forms of wildlife—game animals which furnish sport and meat for man, birds which control dangerous insect pests. They provide windbreaks and shelter and beautify the countryside. They are vital to man's welfare in many ways.

Forestry is, therefore, an important subject for study in our schools. Its fundamental study of trees, their relation as a group and their association with all other life on the earth, is knowledge we cannot afford to ignore. Forestry touches every life, and in this integral capacity, must become an essential part of our education and training, regardless of our vocation.

The urgent problems of management of our southern forests are explained in this book. The state and federal agencies, the industries and many landowners are planning and working night and day to bring our forests to their full fruition of both material and intrinsic values. To help them, every citizen must have a part in the protection, welfare and wise use of our trees. Only under such a policy can our forests bring their full measure of health, pleasure, and prosperity to the people of the South.



U. S. Forest Service

VIRGIN LONGLEAF PINE

UNIT I—

FORESTRY POLICIES PAST AND PRESENT

Chapter 1

OUR FOREST RESOURCES

IN THE Ancient and Middle Ages forests were owned by kings. These monarchs, and the members of their courts, used the vast woodland areas for their personal pleasure and profit. It was often unlawful for the common people to enter the royal forests. Strict laws regulated the use of forest products. In many countries no timber could be secured without the consent of the reigning monarch.

It is recorded that when Nehemiah was rebuilding the walls of Jerusalem it was necessary for him to address an appeal to the *Keeper of the King's Forest* asking for timber to make the beams for the gates of the palace and the walls of the city.

Many interesting stories have come down to us through history and literature which show how strict were the forest laws as they related to the privileges of the common people.

One such story relates to the conversation of a king with a small boy.

As the king, disguised as a traveler, walked among his subjects, he saw a boy gathering wood for fuel. It was a difficult task, for there was little wood along the roadside.

"Why don't you go over into the nearby forest where there is plenty of wood?" inquired the king.

"Oh, I wouldn't dare do that," replied the lad. "The

forest belongs to the king, and he would punish me with death if he knew that I took wood from the Royal Forest."

"But," urged the king, "I will say nothing about it, and I'm sure no harm will come to you."

Constitution Staff Photo

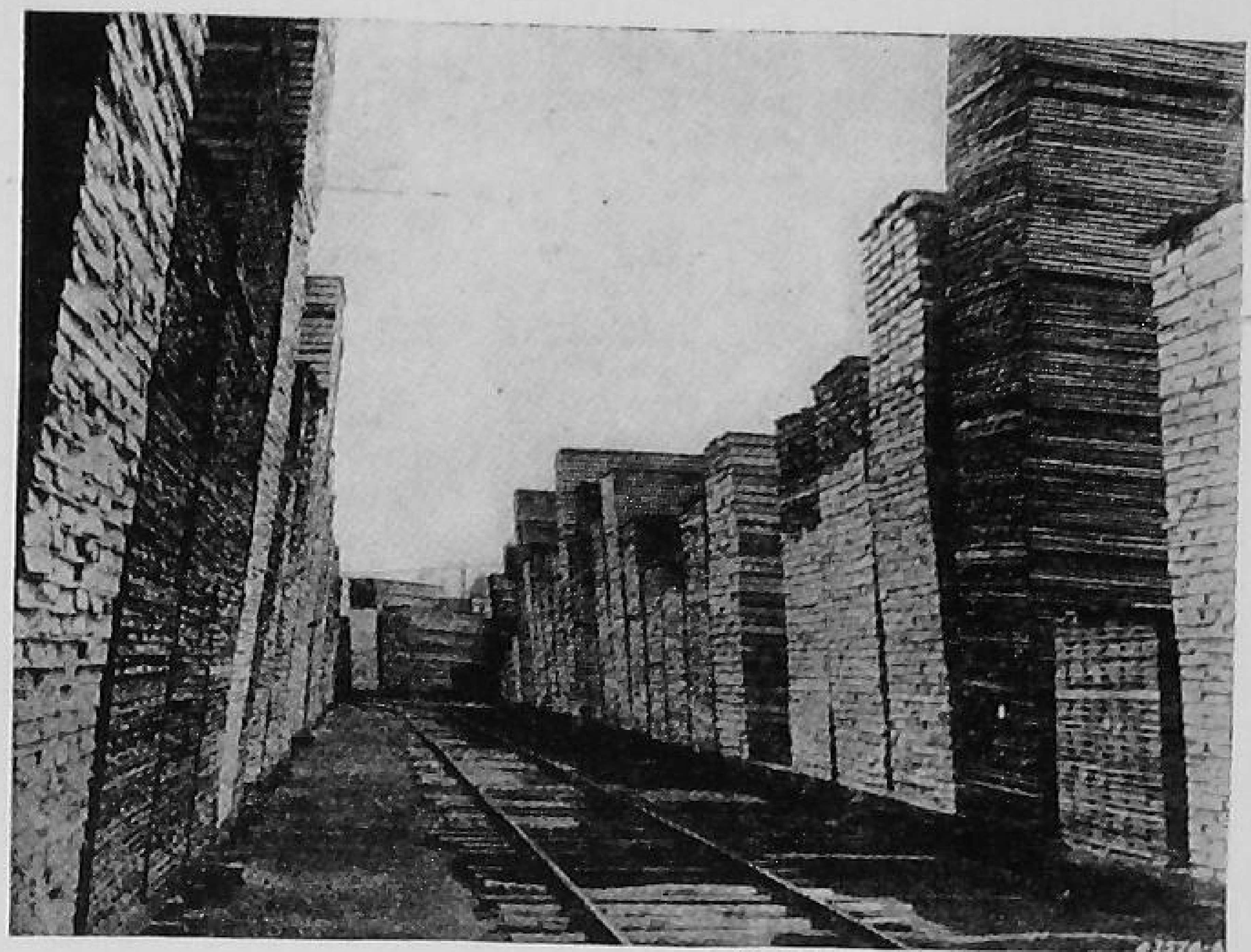
LOW-PRICED "TREE-PLANTER" AT WORK

The low-priced mechanical tree planter, which makes it possible to set out several thousands of tree seedlings very quickly on hilly, eroded acres, is speeding up reforestation

The boy refused, however, to give any consideration to the suggestion.

"What sort of a man is this king of yours?" inquired the man, whom the boy thought to be a casual traveler.

"He is a very hard man," answered the boy. "He denies his people what God has given them."



Courtesy U. S. Forest Service

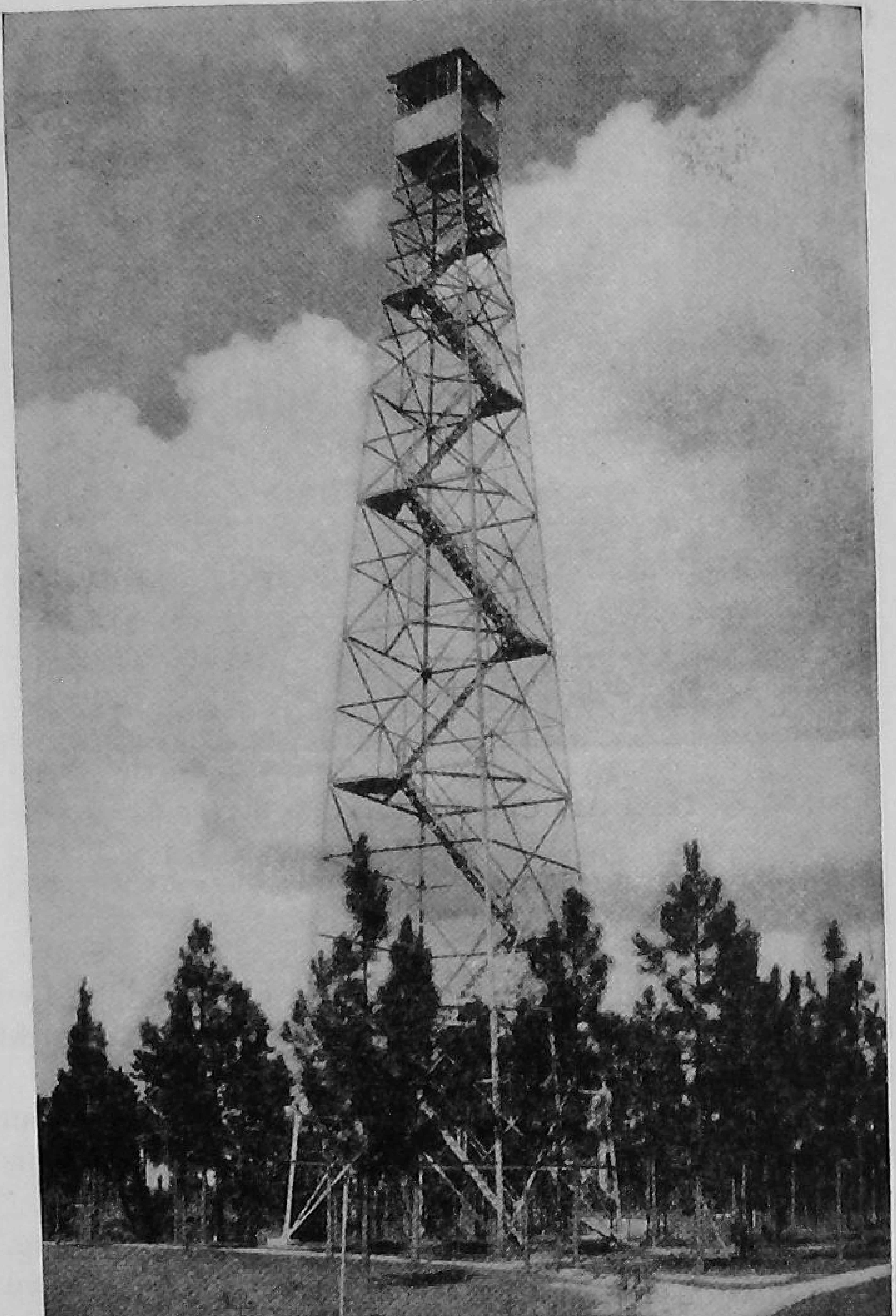
MILLIONS OF TREES ARE CUT ANNUALLY TO SUPPLY OUR TIMBER NEEDS

Lumbering, the first industry of the New World, is still an essential industry in modern civilization

"Then I would pay no attention to his laws," replied the king. "If I were you I'd go right into the forest and get all the wood I needed."

The boy not only refused to go into the forest, but accused the man of being a traitor to the king and his country.

Naturally the attitude of the lad pleased the king. So the next day he sent for the boy and said, "You have taught me a lesson. Hereafter I shall allow my people the use of the forest. They shall gather firewood, so much as they require—but they must use only the trees that are dead, or those that should be removed in order that the better trees may grow larger and become more valuable and beautiful."



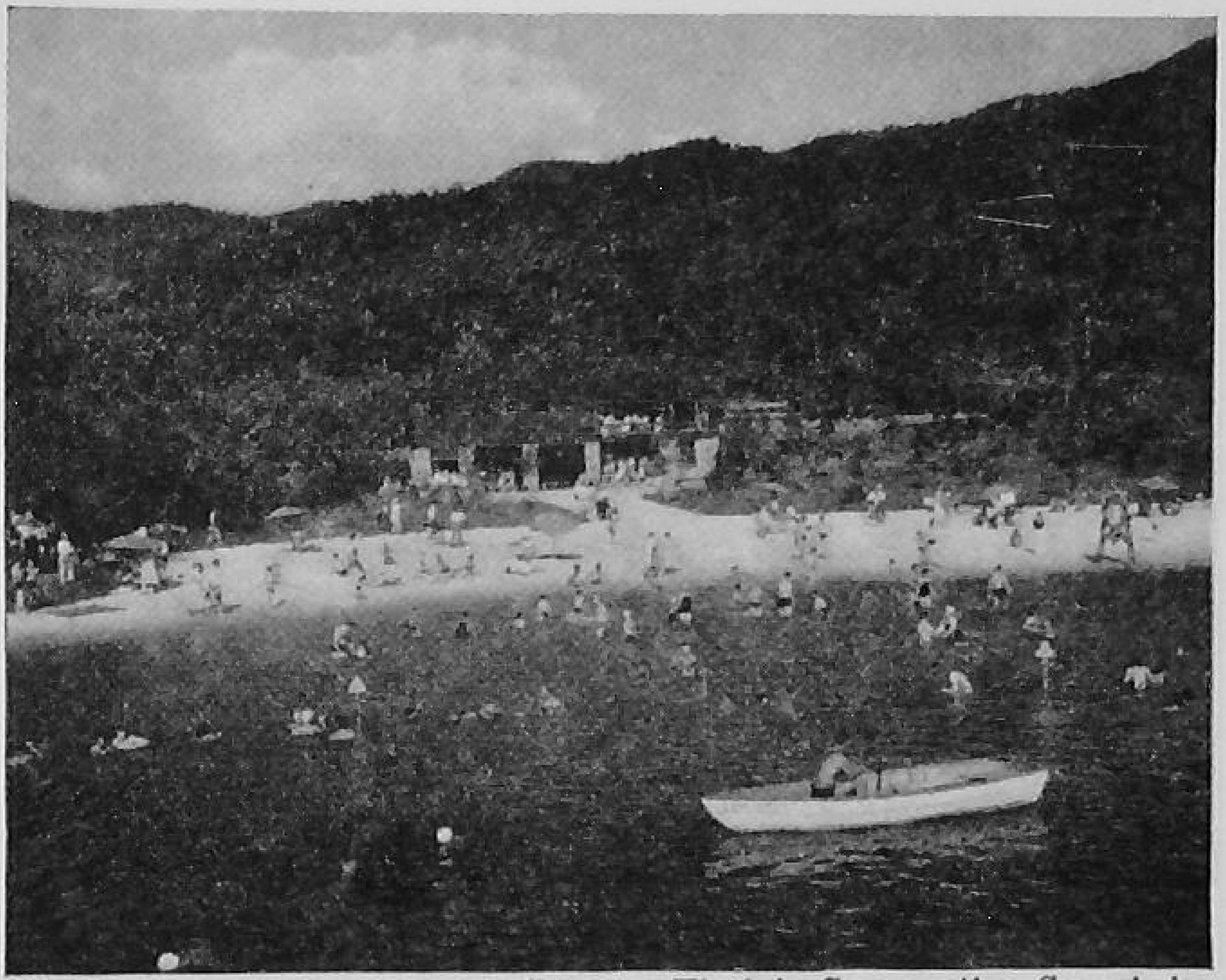
Courtesy Southern Region U. S. Forest Service

"THE EYES OF THE SERVICE"

Towers from which observers can spot fires soon after they start, reduce losses from forest fires; they are often called "The eyes of the service."

This king must have been a very good man, much better than many others who controlled the forests of the earth during the Middle Ages.

Everyone is familiar with the story of Robin Hood



Courtesy Virginia Conservation Commission

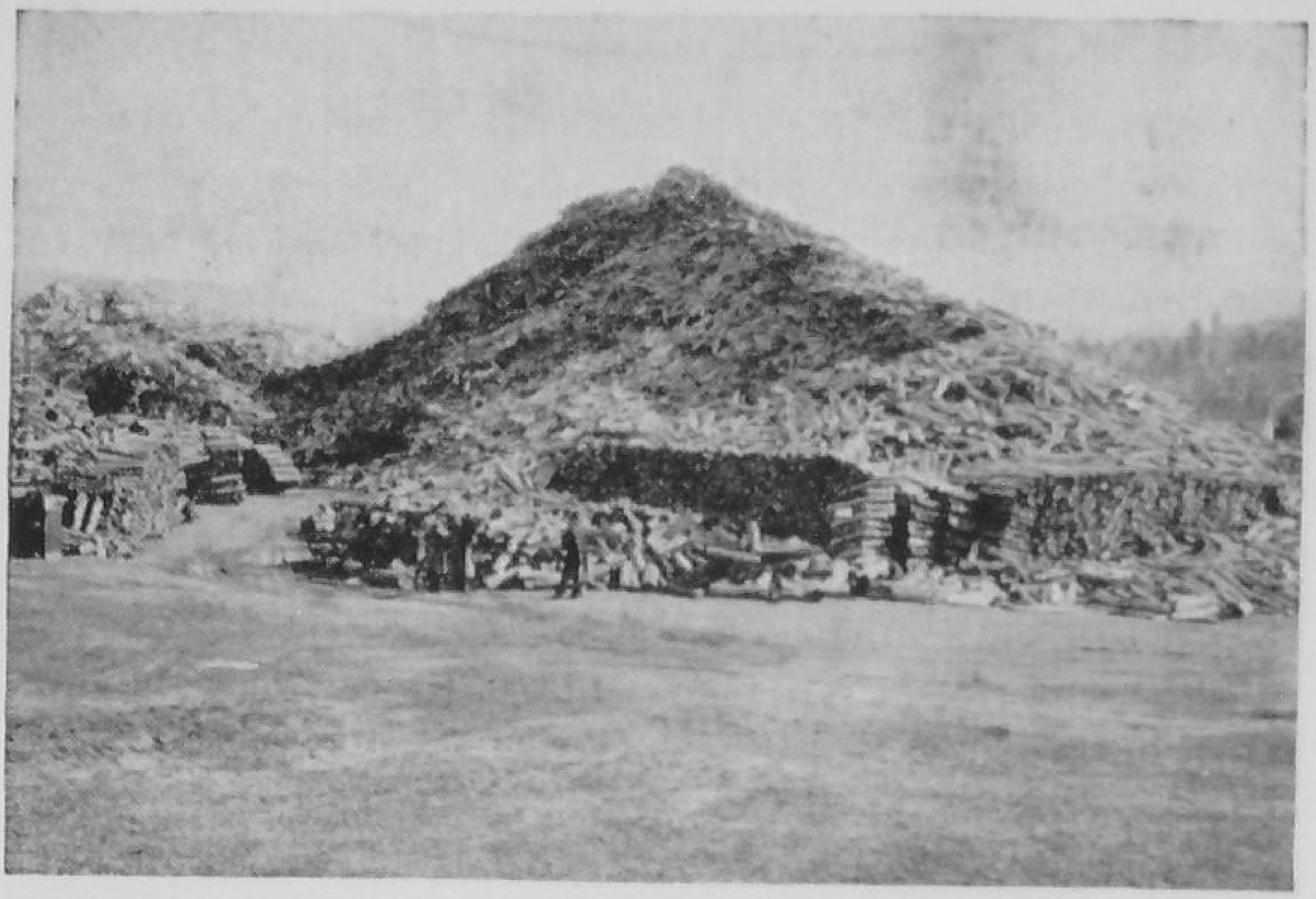
FORESTS AND RECREATION

This beautiful 5,000-acre playground, near Clifton Forge, Virginia, is one of many State Parks in the Southland made possible by the forests which catch and hold the rainfall. Because of the abundant rain, the foliage in southern parks is rich in color, and crystal-clear lakes are formed which afford unexcelled facilities for boating, fishing, and swimming

and his Merry Men who lived in Sherwood Forest in England. These men robbed the rich and gave the goods to the poor. They also hunted in the king's forest and gave the game to those who needed food. It is said, you will recall, that Robin Hood formed his band as a protest against the forest laws. He believed that

they should not be the exclusive property of kings and royal personages, but open to the enjoyment and use of all the people.

These incidents show how highly forest lands have always been regarded in the older countries of the world.



A Mountain of Pulpwood

In all parts of the South paper mills supply an unlimited market for southern pine trees

But in America our forests have been so extensive, until recent years, that we, as a people, have not fully appreciated them.

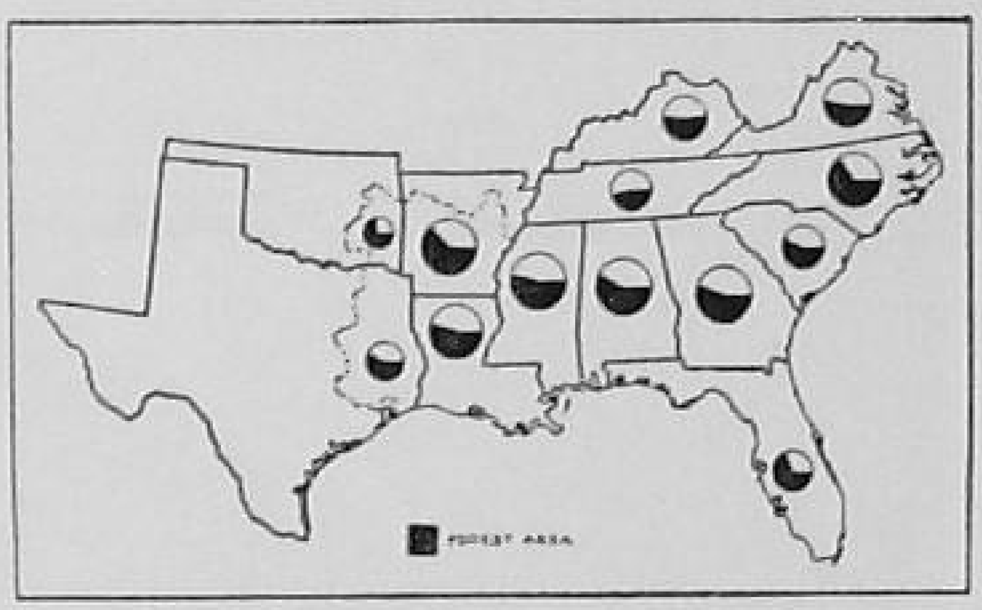
Our Attitude Toward Forests

When the first settlers came to America, all the land in the eastern part of the continent was covered with virgin forests.

These forests provided the logs from which homes were built. Fuel came from the forests. They also sheltered the game which provided much of the food

for the first families of America. Furniture was made from walnut trees; sugar was obtained from the maples; dye was extracted from the butternut for the home-made cloth woven by colonial mothers. In fact, most of the necessities of life came from the forests during the early periods of our history.

But the forests were also regarded as undesirable in many ways by the early Americans. They harbored savage Indians, who objected to the intrusion of the white race. They also sheltered the wild animals that endangered life and property. But most important of all, they prevented the cultivation of the soil.

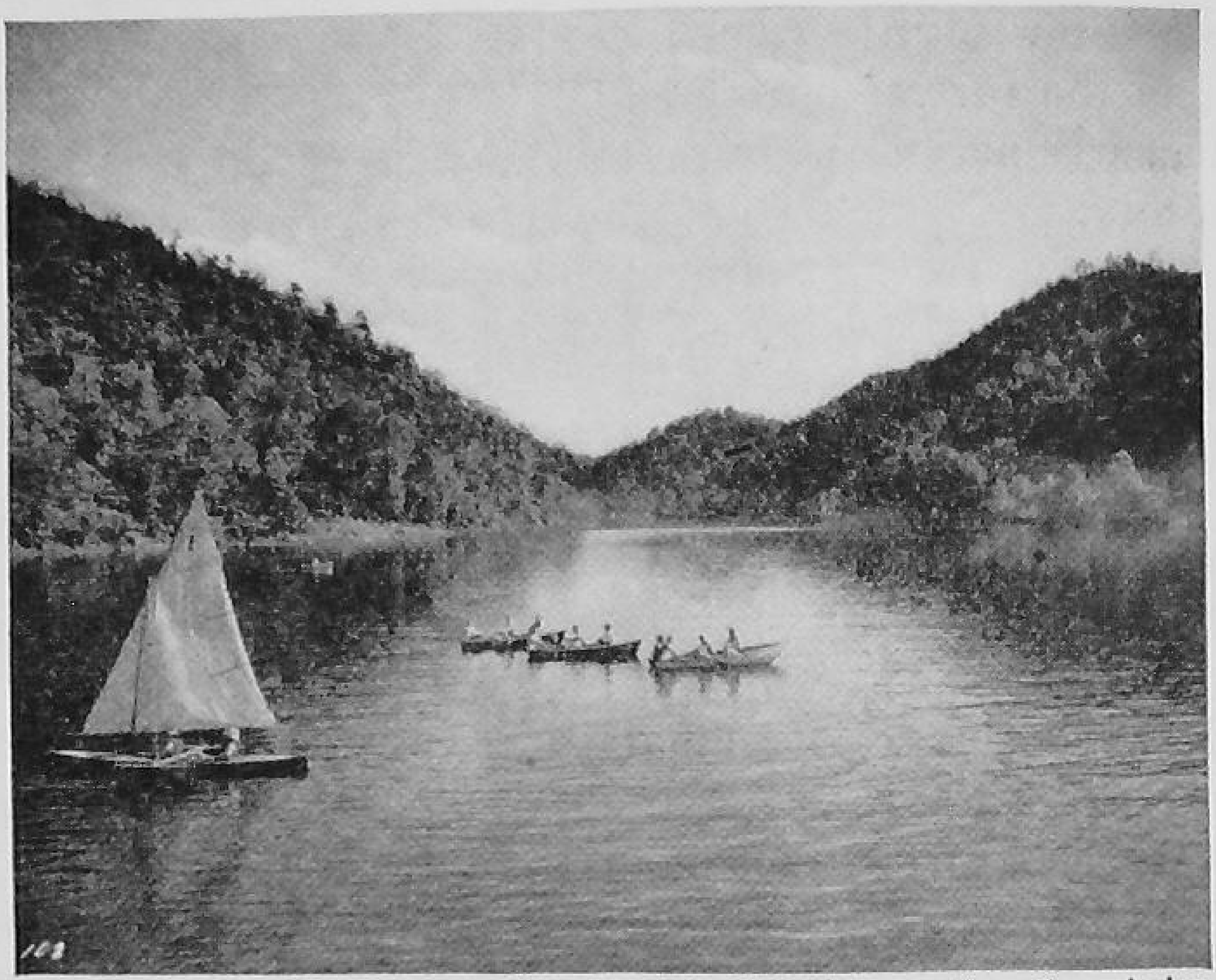


THE RELATIVE AMOUNT OF FOREST LAND IN THE SOUTHERN STATES
(The forest area is shown in black)

As the population increased on the American continent, the demand for food became greater. It was difficult, at that time, to supply the food needs of our people. Forests had to be cut down; land had to be cleared for cultivation. As the venerable trees were cut down the logs were rolled into great piles and burned. This practice prevailed for generations. "Log Rollings" were semi-social events, in which all the community cooperated in the destruction of the forests in order that corn and wheat might be planted. In all, about 300,000,000 acres of forests were completely destroyed.

The ruthless destruction of the great forests of North America by our forefathers seems to us to have been an unthinkable waste of valuable resources. But, at that time there were almost no markets for timber and forest

products as there are today, and, life and development depended upon the expansion of agriculture. Had we been confronted with the problems of the pioneers in the



Courtesy Virginia Conservation Commission

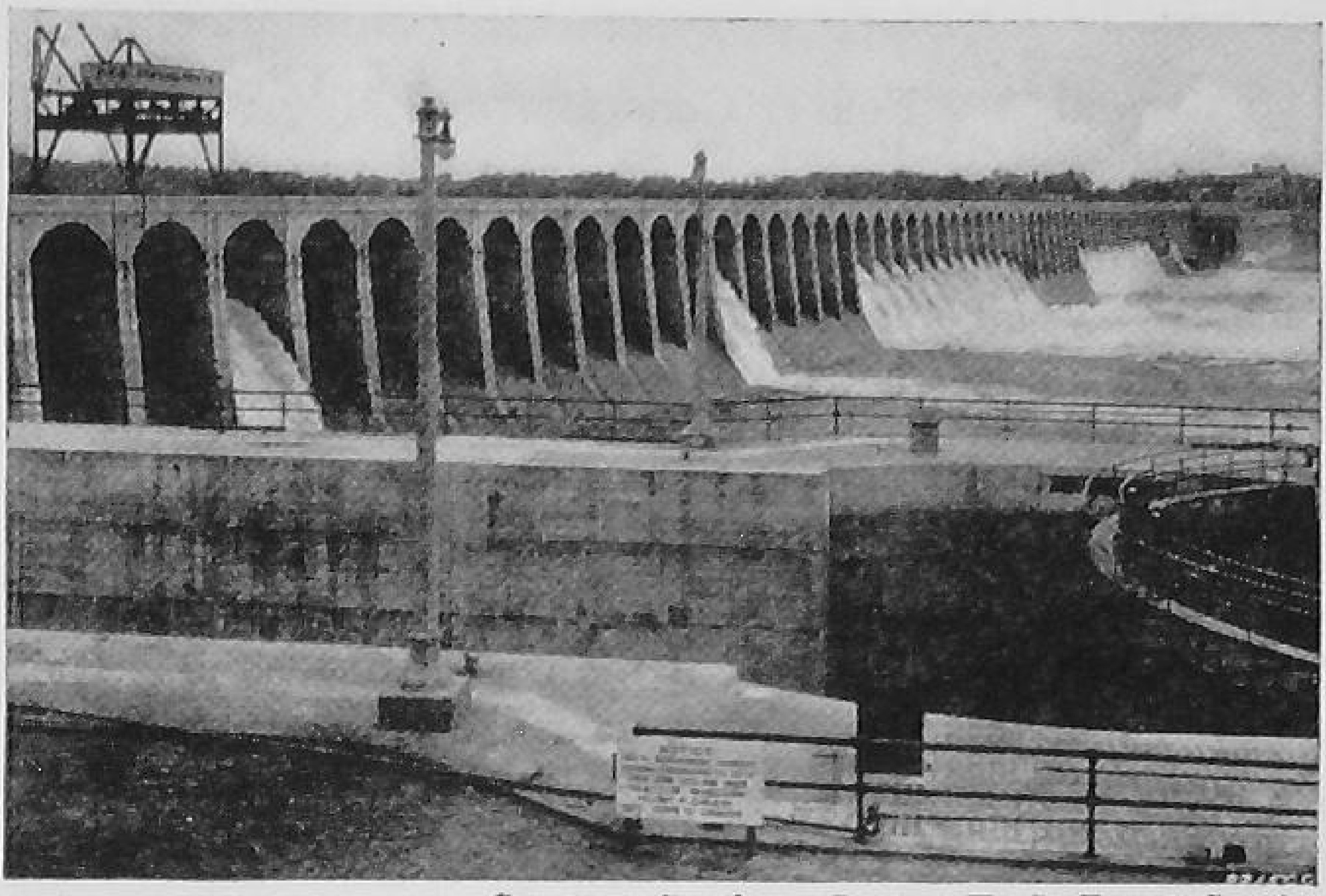
BEAUTY AND UTILITY

Forests in southern highlands help conserve water, provide recreation facilities, promote plant growth, and provide power and light for industry and home use

settlement of this new world, we too would have helped in the destruction of our virgin forests without thought of the consequences to future generations.

But the attitude of the American people has changed. Our problems are different today from what they were two centuries ago.

Today our most intelligent citizens are seeking to conserve and restore our forests. This attitude is again quite logical. Forests are becoming more valuable.



Courtesy Southern Region U. S. Forest Service

FLOOD PREVENTION AND POWER

Great dams have been constructed in the southern highlands by the Federal government and public utility corporations. These dams help prevent floods by storing water in great reservoirs during the periods of excess rainfall. This water, as it escapes under a regulated flow, is used to create the power for industry. Forests aid in making it possible to catch and hold this water

We need forests today more than ever before. Markets for wood and forest products are expanding very fast as new forest products industries are created through scientific research. Also, the increase in the nation's population tends to increase the demands for lumber and other tree products. It is not strange, therefore, to note an ever-increasing interest in the growth and conservation of trees. Forests, as property, are becoming more valuable.

The attitude of the thinking people of America with respect to forest conservation was forcefully expressed in the House of Representatives by the Hon. Martin L. Davey as follows: (Continued on page 15)

Forest Conservation

A forest is more than a collection of trees. It is not merely a wood storehouse. It is a wood factory, a water reservoir, a fish hatchery, a game refuge, and a wild-flower preserve. All these in one the forest truly is.

We are the biggest wood users on the face of the earth. The people of the United States actually use two-fifths of all the wood consumed in the world. I see no chance of an early abandonment of the wood-using habit. The way out of this situation is clear. We have been—and I hope we may continue to be—a nation of wood users, but to enjoy this privilege and the prosperity that goes with it we must become a nation of wood growers.

The biggest mistake made in the lumbering of the past was that no provisions were made for forest renewal. As a result we have vast stretches of idle forest land. It brings no good to anyone. It pays little or no taxes, keeps willing hands out of work, builds no roads, supports no industries, kills railroads, depopulates towns, creates a migratory population, all of which work against a good and stable citizenship. Idle forest land serves no one well.

We must do more than accept Conservation. We must preach it, and, what is most important of all, we must practice it.

If we act the part of good citizens we shall bestow upon our children a wisely conserved heritage of natural resources. By doing this we shall rear to ourselves a monument of noble vision and unselfish enterprise. Such a Conservation policy will make this country a better land in which our boys and girls, and their boys and girls, can become the kind of men and women we want them to be.

—Gifford Pinchot.

America Must Reforest

"Men and women of America, we cut down the great forests that blessed this country. We allow the remnants to be burned over and the vegetation destroyed. The rains pour down water, and instead of being held in check by the loose and porous soil in the network of roots, it rushes down over the hillsides and carries with it the fertile soil, leaving in its wake barren hills and deep ravines.

"Thus we have alternating floods and droughts. The fertile soil is gone, the product of hundreds of years of Nature's providence. The little springs that come from water held in check, and that feed the lakes and streams must gradually diminish, and, I greatly fear, cease to exist in large part.

"This question of reforestation is of monumental importance. America cannot continue to exist as a virile, forward-moving nation unless we protect what we have and start to build up that which we have so ruthlessly destroyed. We cannot afford to be a nation of vandals much longer. America must reforest, or America must drink the bitter dregs of national decline and impotency."

The Importance of Forests

Did you know that human beings could not live on the earth if all the trees and plants were destroyed?

Nature has provided a perfect balance in the use of all the materials of the earth. Nothing is wasted. Everything is used over and over again. In fact, Nature has provided a continuous cycle which, if not disturbed, makes all substances essential to life inexhaustible.

Every boy and girl knows that we live by taking oxygen into our lungs. But do you know why the supply of oxygen is never exhausted?

Men and animals breathe oxygen and expel carbon dioxide. Trees and plants take in carbon dioxide and give off oxygen. In this way the supply of life-sustain-

ing oxygen is never diminished though millions of animals and human beings are using vast quantities each minute of the day. Thus we see that we owe our very existence to trees and other plants. It is also true that trees and plants furnish, directly or indirectly, practically all the food required to sustain the lives of animals and human beings.

Forest Products.—Forests are important to us because of the many products which they supply for the commerce of the world.

Among the forest products, lumber is the one with which we are most familiar. All about us we see the uses made of timber, and those of us who live in the South see the lumber industry as it is conducted by the thousands of persons who engage in lumbering as a vocation.

From the forests we get the wood to make paper. Paper is one of the greatest needs of civilized people. Did you know that the average American citizen used more pounds of paper each year than any other product, except water and milk? And by the same processes in which wood is made into pulp for paper, wood may be made into articles of clothing. It is possible that the time may come when we will be clothed by our forests.

From our forests we get naval stores which have dozens of practical uses in the commerce of the world. We get the material for tanning leather. If it were not for this fact, it is doubtful whether we would use leather for making shoes and other articles of wearing apparel. We also get the wood for furniture, boxes, and many articles of great importance in our daily lives.

But wood is used for making many things we see each day and do not think of as being forest products. Among them we find: cellophane, artificial leather, rayon, photographic films, movie reels, explosives, paint,

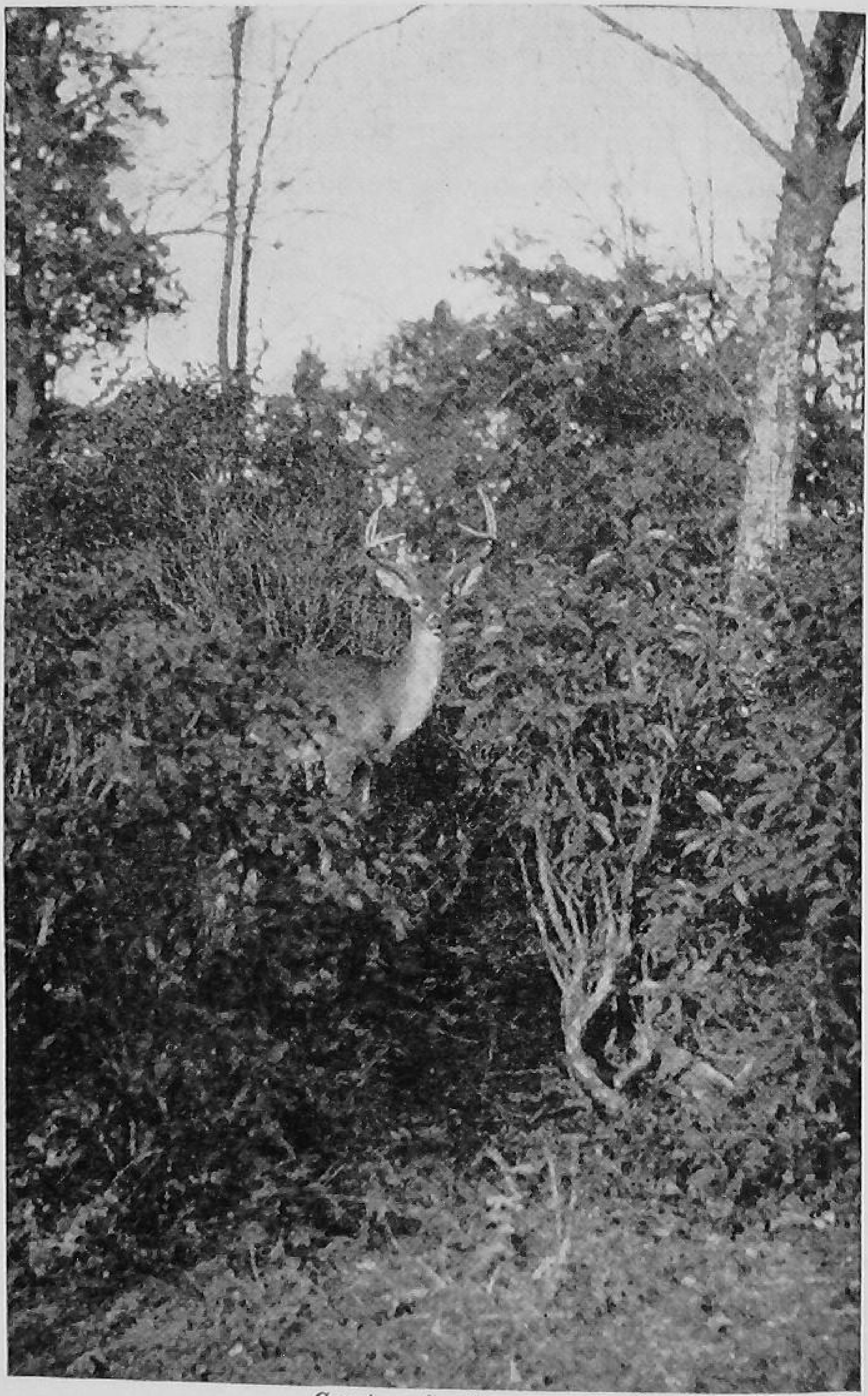
lacquer, plywood, and a long list of other useful things which have been developed by scientists. It appears that there is no end to the possibilities of the use of wood.

Courtesy Southern Region U. S. Forest Service

MEALTIME

This is a scene at the Fawn Farm in the game preserve of the Pisgah National Forest. This is one of the many places in the South where state and Federal agencies are engaged in the interesting work of increasing the wildlife native to the section

Forest Relationships.—In addition to helping sustain life and supplying us with articles of food and commerce, forests have many important relationships in which we are vitally concerned. Let us consider just a few of those which are of vital importance.



Courtesy Southern Region U. S. Forest Service

A Quick-Trigger Camera Man "Shoots" a Fine Buck

This is one of the many fine deer in the Pisgah National Forest. During the open season hunters may be given the privilege of getting such a buck, if they can

Forests affect climate. On the hottest day it is cooler in the forest than elsewhere. Forests increase rainfall, and therefore change the vegetation of any area.

Forests help control floods. Each year there are raging floods in some parts of the nation which destroy life and property. But since the floor of the forest absorbs so much more water than other land, the more forests we have the less likely we are to suffer from the ravages of floods.

We live in an age of power. Most of this power is produced by electricity. Very few of us have ever associated electricity with forests, but, in fact, it is the forests which make possible the water supply that is used in the making of power. In the final analysis, we can have just as much power as our forests make possible. This is one of the very important reasons why we must conserve them.

Forests control the washing of the soil, or what we have come to know as soil erosion. Controlling this loss is one of the major problems of the age in which we live. Forests hold soil better than any other covering of the land. This is indicated by the fact that the streams coming out of forests are clear, while those that flow through cultivated lands are muddy.

Forests are essential as homes for wildlife, and streams for fish. They make recreation sites attractive. Some forest land is needed on every farm. In fact, forests are associated with most of the good things of life.

Forest Regions of Our Nation

One-third of the United States is forest land.

The forests of our nation may be classified, first of all, into two groups: (1) *western forests;* and (2) *eastern forests.* Between these two great areas there

Courtesy Southern Region U. S. Forest Service

TOO LARGE FOR THE CREEL

Fishing is the most popular of outdoor sports. In order to have good fishing, we must have clear streams—this means that we must have forests to prevent erosion of the soil

is a section, comprising almost one-third of the country, in which few trees are found. This section in which there are few trees and no large forests includes North Dakota, South Dakota, Nebraska, Kansas, and parts of

To Him Who Plants a Tree

Perhaps our God has somewhere made a thing
More beautiful to see
Than a majestic tree;
But if He has, I think it grows
In Heaven, by the stream that flows
Where whiter souls than ours do sing.

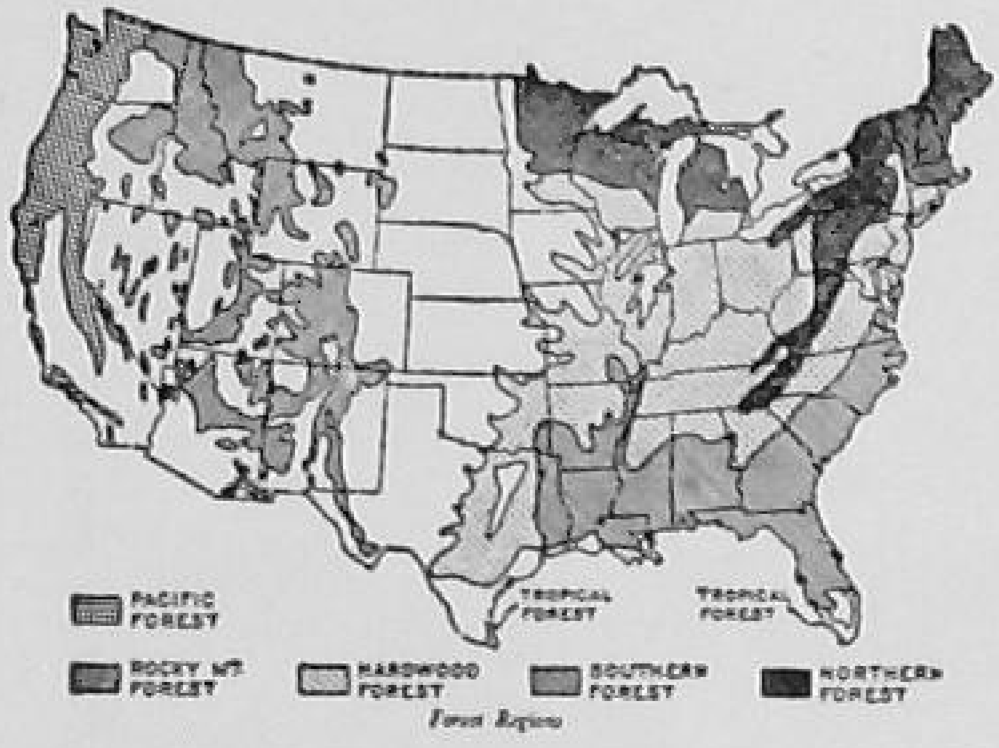
Who plants a tree, he is akin to God
In this impatient age
Where quick returns engage
The fevered service of the crowd;
In reverent wisdom he is bowed
And hides his purpose in the cloud.

The blessed man that plants a long-lived tree
That shall grow nobly on
When he is dead and gone
He seems to me to love his kind
With true sincerity of mind;
He seems to love his fellow yet to be.

Above his grave the suns shall flush and fade,
The seasons come and go
And storms shall drive and blow;
But sun and rain that from his tomb
Efface his name, renew the bloom
And glory of the monument he made.

—Author Unknown.

Montana, Wyoming, Colorado, Oklahoma, and Texas. It is in this section that dust storms developed, as the result of wind erosion. And it is for this section that the great shelter belt of trees was planned. It is the hope of many persons that someday we may have a "belt" of planted-trees in this section which will be one hundred miles wide and extend from Canada to Mexico.



PRINCIPAL FOREST REGIONS OF THE NATION

In the great central portion of the United States, where there are no forests, an attempt is being made to plant a great shelter belt of trees one hundred miles wide reaching from Canada to Mexico

Western Forests.—The forests of the West are divided into two regions: (1) the *Rocky Mountain Region;* and (2) the *Pacific Coast Region.*

The Pacific Coast Region begins in the State of Washington at the Canadian border and extends through Oregon into California. Most of the forest trees of California are located in the northern portion of the state. It is here that the giant redwoods are found.

The Rocky Mountain Region extends over a large area, but, on account of the mountains, is broken up into a great number of relatively small forests. The largest part of the timber in this region is found in the Northwest, especially in Washington, Oregon, Montana, and Idaho. This is the region in which are located the national forests with the greatest acreage, as well as the most famous of our national parks.

Heavy stands of timber characterize the Pacific Coast Region. Over one-half of the total saw timber

of the United States is in the forests of California, Washington, and Oregon; about four-fifths is found west of the Great Plains, in what has been described as the western forests.

Douglas fir, western hemlock, Engleman spruce, and white and lodgepole pine are among the more important trees of the western forests.

Courtesy Southern Region U. S. Forest Service

GROWING PINE SEEDLINGS

These boys, and hundreds of others in the southern states, are growing pine seedlings for the landowners of this section of the nation to use in planting new forests. For two hundred years we have been destroying our forests; now we are attempting to replace them

Eastern Forests.—There are four forest regions in the eastern part of the United States. These are: (1) *Northern Region;* (2) *Central Hardwood Region;* (3) *Southern Region;* and (4) the *Tropical Region.*

The Tropical Region is the smallest in area of the six in the nation. It includes only the southern part of Florida and a very small bit of Texas which lies on the

Gulf of Mexico. Economically the forests of this region are relatively unimportant, but the mangrove swamps, the royal palms, and the yew trees make it unique from the standpoint of North American scenery.

The Southern Region begins in Delaware and extends into Texas. It does not include all of any of the south-

Courtesy Southern Region U. S. Forest Service

Cherokee National Forest Invites You

Every provision is being made in southern national forests and state parks for the convenience and comfort of visitors

ern states except Louisiana and Florida. It extends, however, into Arkansas, and even for a few miles into Missouri. It follows, for the most part, the fall line, which divides many of the southern states into the Coastal Plain and Piedmont sections. *This is the largest of the forest regions.* In many respects it is the most important for within the region lies all of the Naval Stores Belt, many of the paper mills and large lumber

companies of the eastern portion of the United States, and here trees grow faster than in any other portion of the nation. The most important trees of the region are the pines, especially the longleaf and slash. But here are also found many other important species including the cypress, sweet gum, swamp black gum, tupelo gum, willow oak, water oak, bays, cotton woods, and willows.

The Central Hardwood Region includes the Piedmont Plateau of the Coastal States, the Mississippi Valley, West Virginia, Tennessee, Kentucky, Eastern Oklahoma, and Central Texas. This is an area of dense population. The original forests disappeared many years ago; in fact, most of the land has been "cut over" many times. The woodlands of this section are, for the most part, in the hands of owners engaged in farming. Numerous species of trees grow in this region including oaks, hickories, tulip poplars, ashes, elms, maples, and pines.

The Northern Region includes the New England States, New York, and parts of Pennsylvania, Michigan, Minnesota, and Wisconsin. But, in a long narrow line, it dips down into the South by extending through Virginia, North Carolina, and even down into the uppermost counties of Georgia. This, of course, is due to the high altitude of that section of the South, and accounts for the very delightful summer climate in the Southern Highlands.

In the Northern Region are grown red, black, and white spruces; balsam fir; white, red, jack, and pitch pines; hemlock; sugar and red maples; beech; and red, white, black, and scarlet oaks. It was in this region too—in the southern portion—that the chestnut was grown, but, unfortunately, most of these beautiful trees have been killed by a blight, which, as yet, remains uncontrolled.

Forest Regions and the South.—It will be noted that of the six recognized forest regions of the United States, we have all of two and a portion of two others in the South. It will also be noted, from the following table, that we have in the South the largest forest acreage of the nation.

THE AREA OF THE SIX FOREST REGIONS

Region	*Area in Acres*
Southern	150,000,000
Central Hardwood	132,000,000
Northern	85,000,000
Pacific Coast	68,000,000
Rocky Mountain	64,600,000
Tropical	400,000
Total forest area of the nation	500,000,000

Of the total forest area of the United States, we have forty-seven per cent in the southern states.

More than one-half the total growth of all timber, including saw timber, is taking place in the one-fifth of the national forest area which lies in the Southeastern States.

The total supply of wood suitable for paper pulpwood is estimated at 1,800,000,000 cords, or units. This is about one-third of the total quantity of wood of all kinds and sizes in the United States. Nearly one-half of this wood is in the Southeastern States; one-fifth in the Pacific Coast Region; one-tenth in New England; and the rest in the Central and Rocky Mountain Regions.

The South ranks first among the sections of the nation in the number of acres devoted to forests; it ranks first too in the size of the wood "crop" which is being grown. For these reasons our forests are of great eco-

nomic importance and in the management of them we must learn to apply progressive forest policies.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Who owned the forests during the Ancient and Middle Ages? What was the principal use made of forests by the owners in the early periods of history? Do you know any stories about the common people and the forests other than those related in the text?
2. How did the forests help the first settlers in America?
3. How did forests impede progress in the early periods of this country?
4. Why did the colonists cut down the forests? Why did they burn the timber instead of selling it as we would today?
5. How has the attitude of the American people changed concerning our forests? How do you explain this change in attitude?
6. What is meant by forest conservation? Do we have other forms of conservation in which we are interested?
7. What is a forest, as expressed by Gifford Pinchot?
8. What does the expression mean—*America Must Re-Forest?*
9. How are forests important in sustaining life?
10. Name some of the food products we get from trees.
11. Name five products other than food products that we get from forests.
12. How are forests related to the clothing we wear? What is rayon?
13. How do forests affect climate?
14. What is the relation of forests to floods? Can you explain?
15. How are forests related to agriculture?

16. How are forests related to power? To soil erosion control? To recreation? To wildlife?
17. Why are the streams clear that flow out of forests?
18. How many forest regions are there in the West? In the East?
19. Name the six forest regions. How many do we have in the South?
20. What are some of the trees grown in each region?
21. Which is the largest region? The most important?
22. In what part of the nation is the greatest timber growth taking place?
23. What part of the land in your state is devoted to forests? (See map)
24. Discuss the importance of forests to the South.

Selected References

Forest Service, U. S. Department of Agriculture, Washington, D. C.

Special Bulletins

What Forests Give

Taming Our Forests

Here Are Forests

Great Forest Fires of America

Miscellaneous Publications

217—Forest Trees and Forest Regions

249—Careers in Forestry

290—The Work of the U. S. Forest Service

Office of Education, Department of the Interior, Washington, D. C.

169—Analysis of Special Jobs in Farm Forestry

State Publications—Each state in the South has a Department or Division of Forestry which issues bulletins and circulars for free distribution within the state. Other departments also publish material dealing with forestry and related sub-

jects. The bulletins listed below are not all correlated with the subject matter in this chapter, but they are typical of the publications which may be secured upon request.

Alabama—*Suggested Items for Use in Programs for the Observance of Arbor Day*, State Commission of Forestry, Montgomery.

Arkansas—*Annual Report of the State Forestry Commission*, Little Rock.

Florida—*Course in Conservation of Florida's Forest*, State Department of Public Instruction, Tallahassee.

Georgia—*Keep Georgia Green*, State Department of Forestry, Atlanta.

Kentucky—*Forest Trees of Kentucky and How to Know Them*, State Forest Service, Frankfort.

Louisiana—*Ten Lessons in Forestry*, Louisiana Forestry Commission, Baton Rouge.

Mississippi—*Report of State Game and Fish Commission*, Jackson.

North Carolina—*Outdoors in North Carolina*, Department of Conservation and Development, Raleigh.

Oklahoma—*Forest Facts for Oklahoma Folks*, The Oklahoma Forest Service, Oklahoma City.

South Carolina—*Statewide Fire Protection Program*, State Commission of Forestry, Columbia.

Tennessee—*Forestry for Farmers*, Department of Agriculture, Division of Forestry, Nashville.

Texas—*Texas Forest Facts*, Forest Service, College Station.

Virginia—*Virginia's State Parks*, Virginia Conservation Commission, Richmond.

Suggested Activities

1. Make a list of the things you use each day which come from our forests. In a second group, make a list of all the other forest products with which you are familiar.

2. Read the *Introduction* and then write, in your own words, a short article on the subject: *The Importance of Forestry in the South.* Place major emphasis upon forestry in your own state.
3. Make an outline map of the United States and indicate the location of each of the *Forest Regions.* Within each, or below the map, give the number of acres in each Region.
4. In this chapter there is reproduced a very beautiful poem called: *To Him Who Plants a Tree.* This is but one of many poems about trees and forests. See how many others you can find, and then read them to the members of your class.
5. Watch your newspapers and magazines for articles dealing with forestry. Select those which appeal to you as being worth while and either paste the clippings in your notebook, or if this isn't possible then write a brief review of the article.
6. Write to the U. S. Forest Service, and to your State Department of Forestry and ask for a list of their available publications so that you may request copies of those which will be helpful to you in your study of forestry.

Chapter 2

PROGRESSIVE FOREST POLICIES

THE Yale School of Forestry which is located at New Haven, Connecticut, maintains a camp in the South. Each year the students come to their southern headquarters for a period of practical study and observation in the woods.

On one of their hiking trips, these Yale students found something very unusual. It was a *ghost town.*

"Suddenly," said one of the boys in telling the story, "we came to a clearing. All the trees had been cut down. There was nothing growing, except broom sedge. In the distance we could see many buildings. It looked like a town. We moved toward it. As we came near, we remarked that it was strange that no people were in evidence. A closer inspection revealed that the houses and store buildings were empty. There were no people on the streets, which had grown up in weeds. The buildings were in a dilapidated condition. It was the picture of desolation. We thought first that there was no living soul within miles, but suddenly, as from nowhere, an old Negro appeared. We called to him.

" 'Where are the people who live here?' we asked.

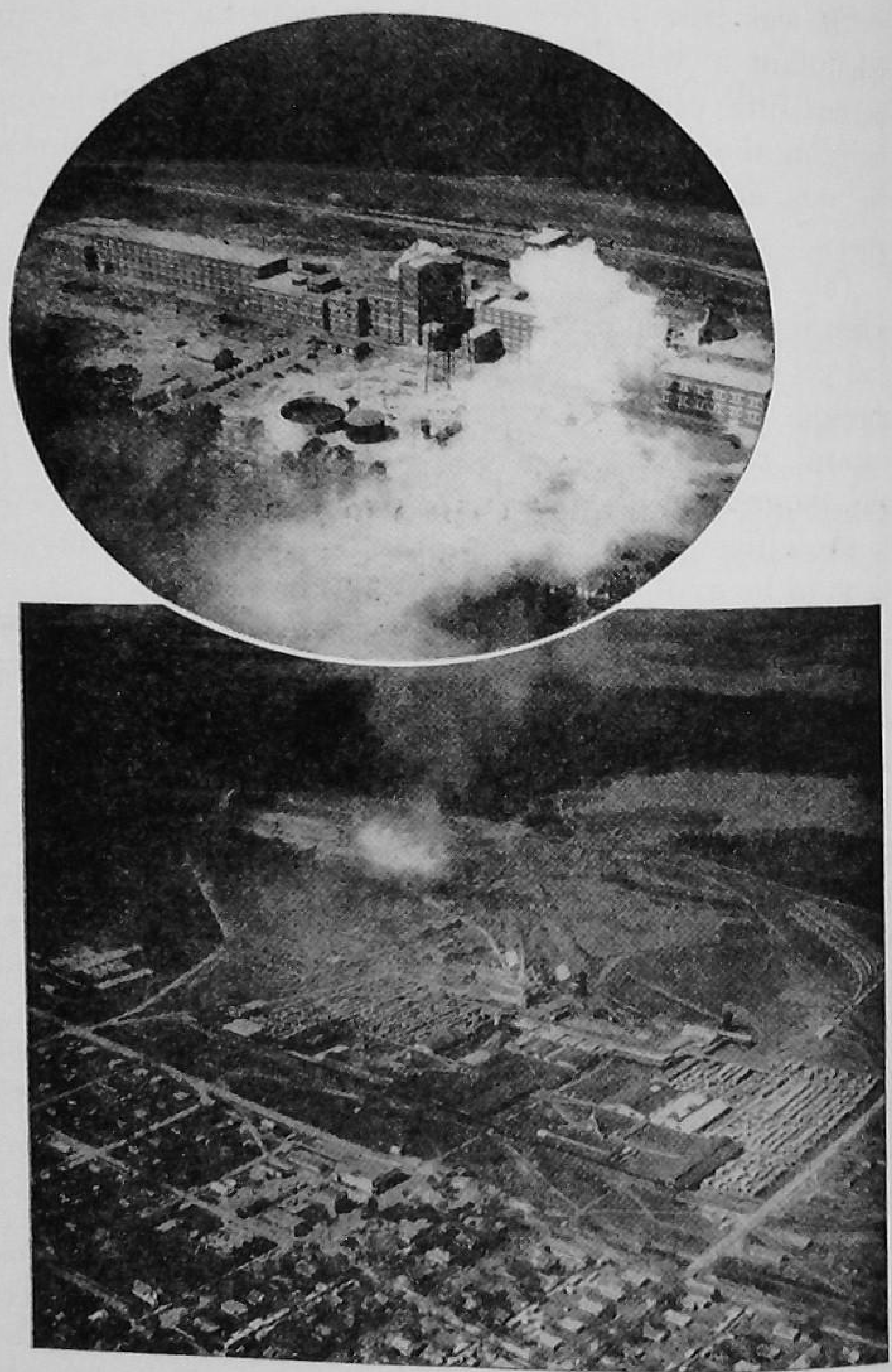
" 'There are no people here,' he replied.

" 'But all these houses, what do they mean?'

" 'The folks left when the sawmill quit,' he answered.

" 'But you, do you live here?'

" 'Yes sir, I live in the bank.'



Above: The Crossett Paper Mill
Below: The Town That a Forestry Industry Built

Crossett, Arkansas

"It was true. This old Negro was the only living inhabitant in what had once been a thriving and prosperous little city. He lived in the vault of the decaying building that had once been the bank of the community. He was alone. No other person had lived there for years."

This is the story of an old lumber town in the days when it was the policy of sawmill companies to "cut out and get out." It is typical of the *period of exploitation* through which this country passed in which our vast natural resources were wasted and destroyed without any thought of the future. These resources belonged to the citizens of this nation, yet they have permitted them to be exploited by private interests.

The period of exploitation finally has passed. The ruthless waste of our natural resources is no longer approved by our people. We have, let us hope, learned a lesson that will continuously guide our future actions. From this period of wastefulness, we are moving toward a *period of conservation* in which the natural resources of the country are to be protected and conserved. In connection with our forests, we are urging that progressive policies replace those of waste and destruction that were all too common in the past.

Fortunately, all lumber companies have not operated in the ruthless manner that left destruction and ghost towns in their wake.

A Progressive Industry

Years ago, in the 1890's, the Crossett Lumber Company moved into the center of an Arkansas forest. To meet the needs of their employes, the Company established the town of Crossett, Arkansas, and built residences, an advanced public school system, churches, a hospital, a public utilities plant, and a recreation center.

Crossett is now an incorporated municipality. The people govern themselves, make their own laws, and elect a mayor, board of aldermen, and other city officials by popular vote.

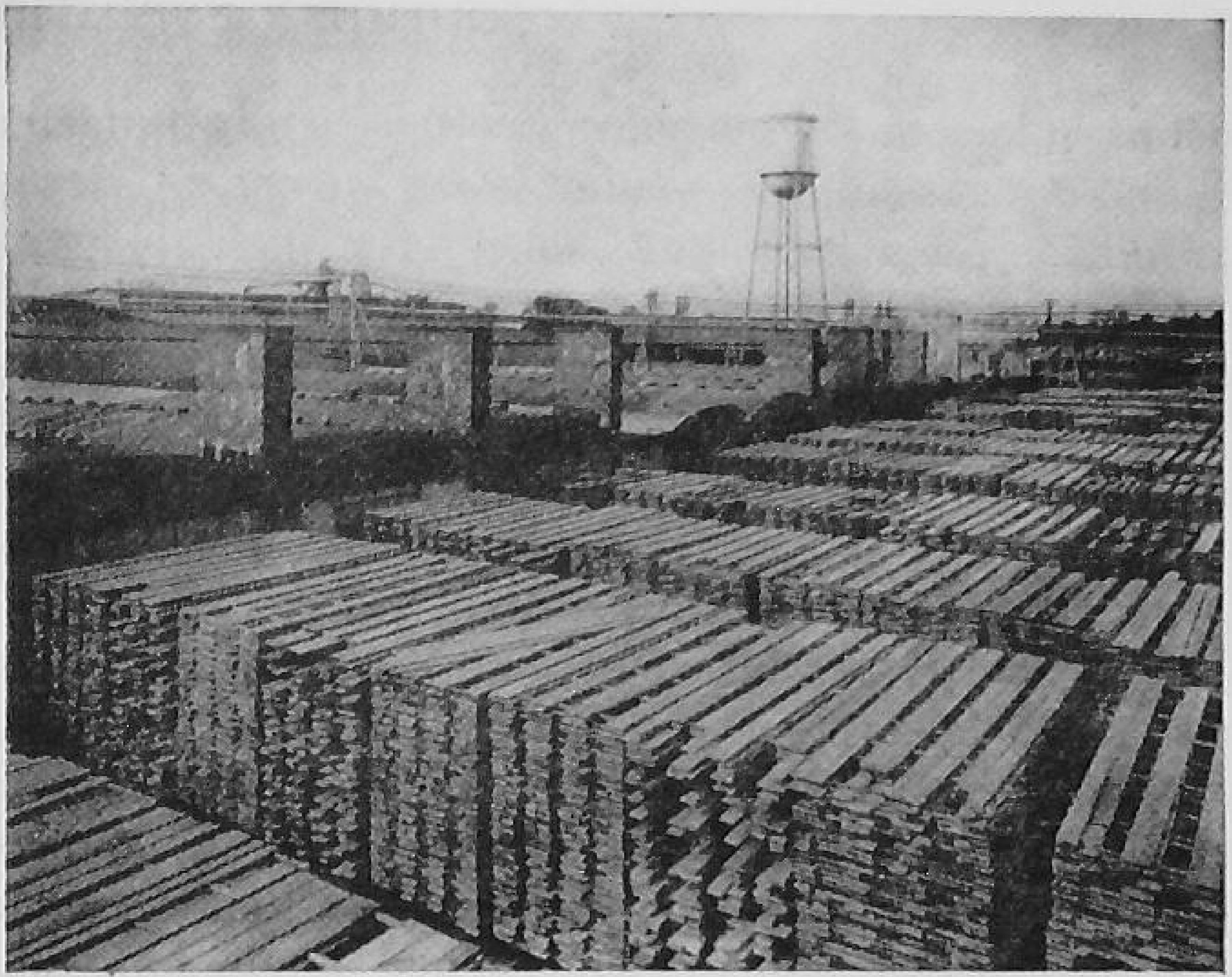
The Company bought 400,000 acres of woodland, which it still owns. And in spite of the fact that it has been in business in this one location for more than forty years, the forests it owns are more valuable today than they were at the time they were acquired.

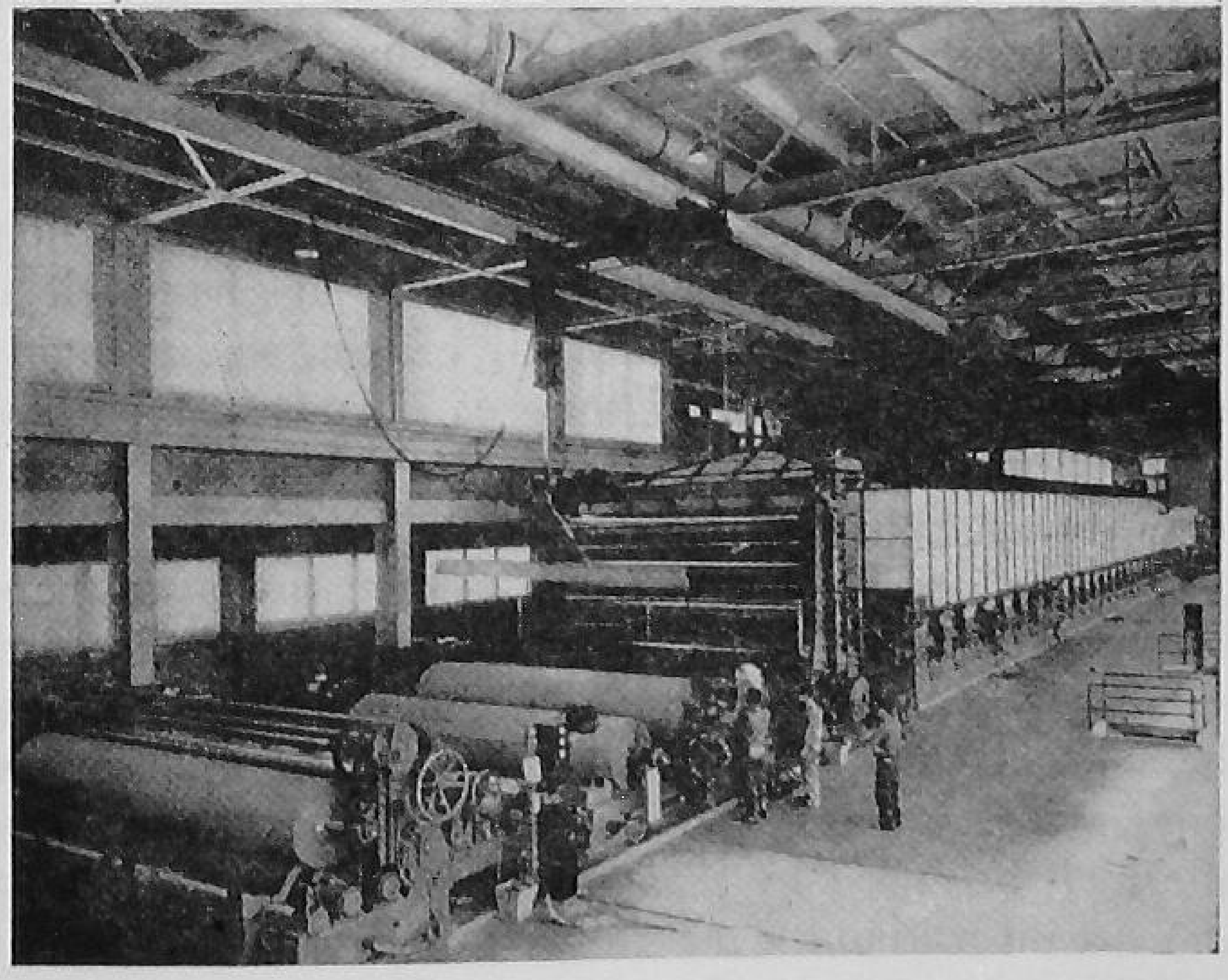
The Crossett Company follows a scientific wood-cutting policy. Its directors know how much wood will be grown on their holdings in one year, and they cut no more than that amount. The industry has proved beyond doubt that it can live continuously in this one locality. Therefore the town of Crossett has a permanent future. It is such a business as this company that is an asset and not a liability to the section where it is operated.

But the Crossett Lumber Company is not satisfied merely to cut its forest holdings wisely, it utilizes all the materials that are cut from the timber, just as it is said that the meat packing houses use all of the pig, except the squeal. *Collier's* magazine published a story about this remarkable industrial organization under the title—*If We Only Had More Towns Like This.* The following extract is selected from that article:

"The wise men at Crossett are giving their forests a further break by preventing waste in the 400,000 acres they own and the almost as many more that they control. There is no trash lying around to propagate forest fires, and neither is there at their mill a perpetual fire burning in a waste pit, consuming vast quantities of good wood. In fact, at Crossett, there is no waste to burn.

"To find out what becomes of it, I went through the plant, noticing first of all a million or more little sticks a





Above: Train Loads of Lumber

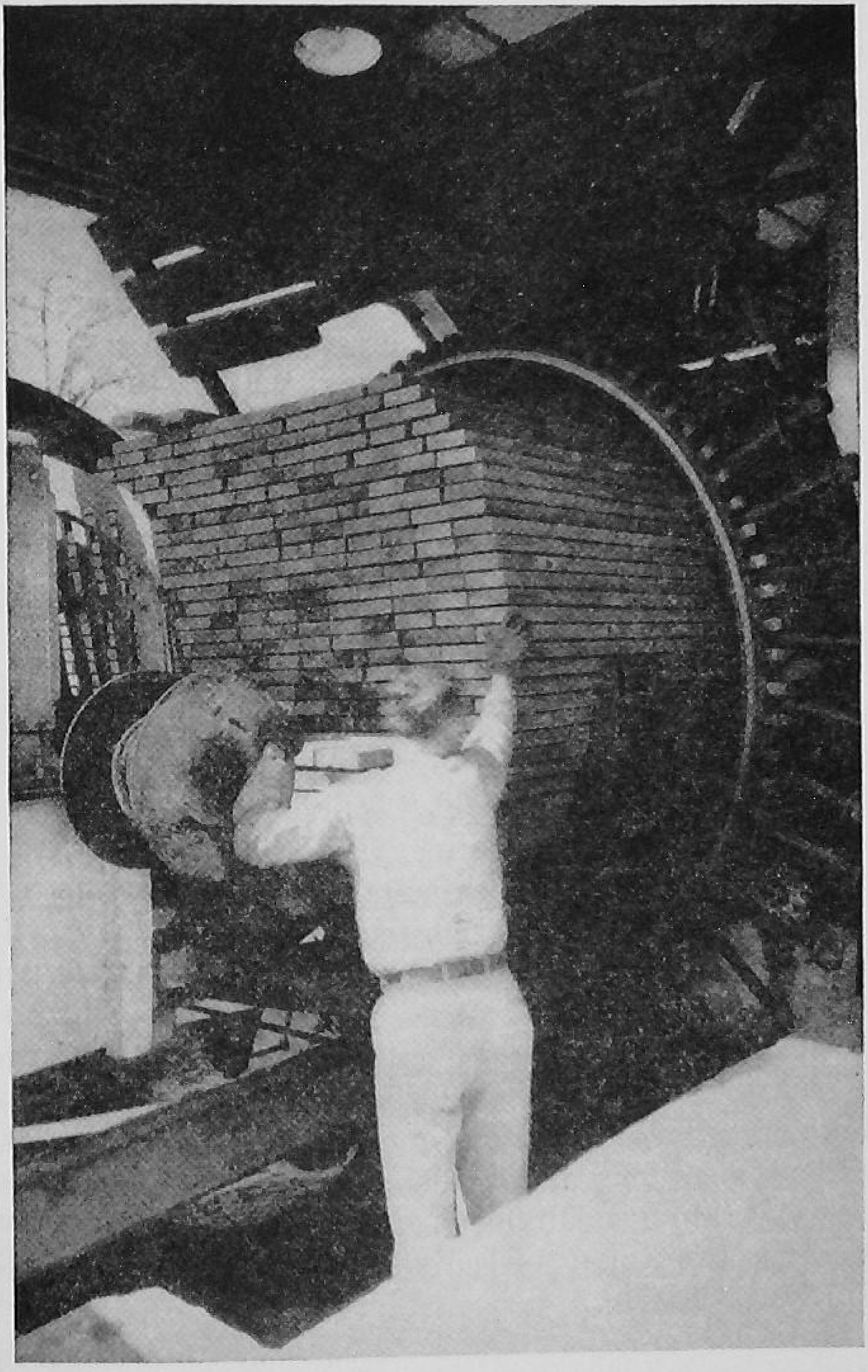
Yet the sustained yield policy of the Crossett Lumber Company makes possible a permanent industry

Below: The Crossett Paper Mill

foot or so long and three quarters of an inch in diameter, all tied up in bundles instead of being burned as in most sawmills. They go to toy makers for such things as handles for little beach-shovels and miniature garden tools. Again, in the hardwood flooring mill I noticed that every short piece, if it was more than six inches long, was being bundled, and I found that the Crossett mill demands that on every sale of flooring it be allowed to include 10 percent of short pieces. This doesn't hurt the floor, I was informed, and it certainly prevents waste. So does their box factory. Rough slab from next to the bark on the logs, and short, broken stuff, is turned into slats for berry crates. Also, in another special department, narrow strips of clear lumber, otherwise useless, are glued together and made into non-warping ironing boards and sink drains.

"Then there is the wood distillery, into which other 'waste'—six cords at a time—is run through a series of superheated chambers wherein, without ever catching fire or being approached by an open flame, it is reduced to charcoal. Charcoal, of course, is highly marketable, selling for all sorts of purposes, from artist's material to chicken feed. Neither is there any waste to speak of in the saps, oils and acids that are evaporated out of the wood in the heating chambers. These pass through a condenser, come out in the form of a brownish liquid, go on to the distillery and are there broken up into wood alcohol, acetic and several other acids, and also into liquid smoke, vast quantities of which are used by meat packers in 'smoking' hams and bacon without ever really smoking them at all.

"And when all that has happened to a Crossett tree, when it has been turned into everything from anti-freeze to bridge timbers, what is left of it? Nothing. Nothing, that is, except a very small quantity of black pitch



Lumber being placed in a pressure vacuum at Crossett where it is treated to make it resistant to termites and decay

which has no present value because, within a very slight temperature range, it either becomes very brittle or very soft. However, the Crossett wood chemists are not discouraged. They are still experimenting with that pitch, determined to find a use for it so that thereafter there need be no waste whatever to the tree.

"But the situation at Crossett, it must be emphasized, is very, very exceptional: the country over, right now, we are using five and one-half times as much timber as the annual growth. We need many more Crossetts—permanent, prosperous towns surrounded by permanent, flourishing forests."

A Progressive Individual

Forestry is a new science. Few people have studied forests as they have other *crops*.

Individuals have followed, in the main, the same thoughtless and destructive methods that characterized the lumber companies which first cut over our forest lands. But here and there an individual may be found who has seen the possibilities of growing trees as a crop. Such a man is James Fowler of Soperton, Georgia. A report of what he has done might well be given the title: *The Story of a Million Pines.* Or it might be called, *A Forestry Dream That Came True.*

Here is the very interesting story:

Years ago, James Fowler was a big-scale farmer. Like other large operators in the South, he grew cotton and corn and a few other cultivated field crops. His system of farming was typical of that which had been followed in the region for many generations, but it was not always profitable.

One fall, as he counted the returns from his farming operations and their costs, he found that he had made no money from the sale of his crops; in fact, the returns had

not been sufficient to pay for fertilizer, seed, labor and other expenses.

But his forested lands, where there was an excellent stand of longleaf pines, had brought in a sizable cash return from rosin and turpentine; and one section of the plantation had yielded nice returns from the sale of its mature saw timber.

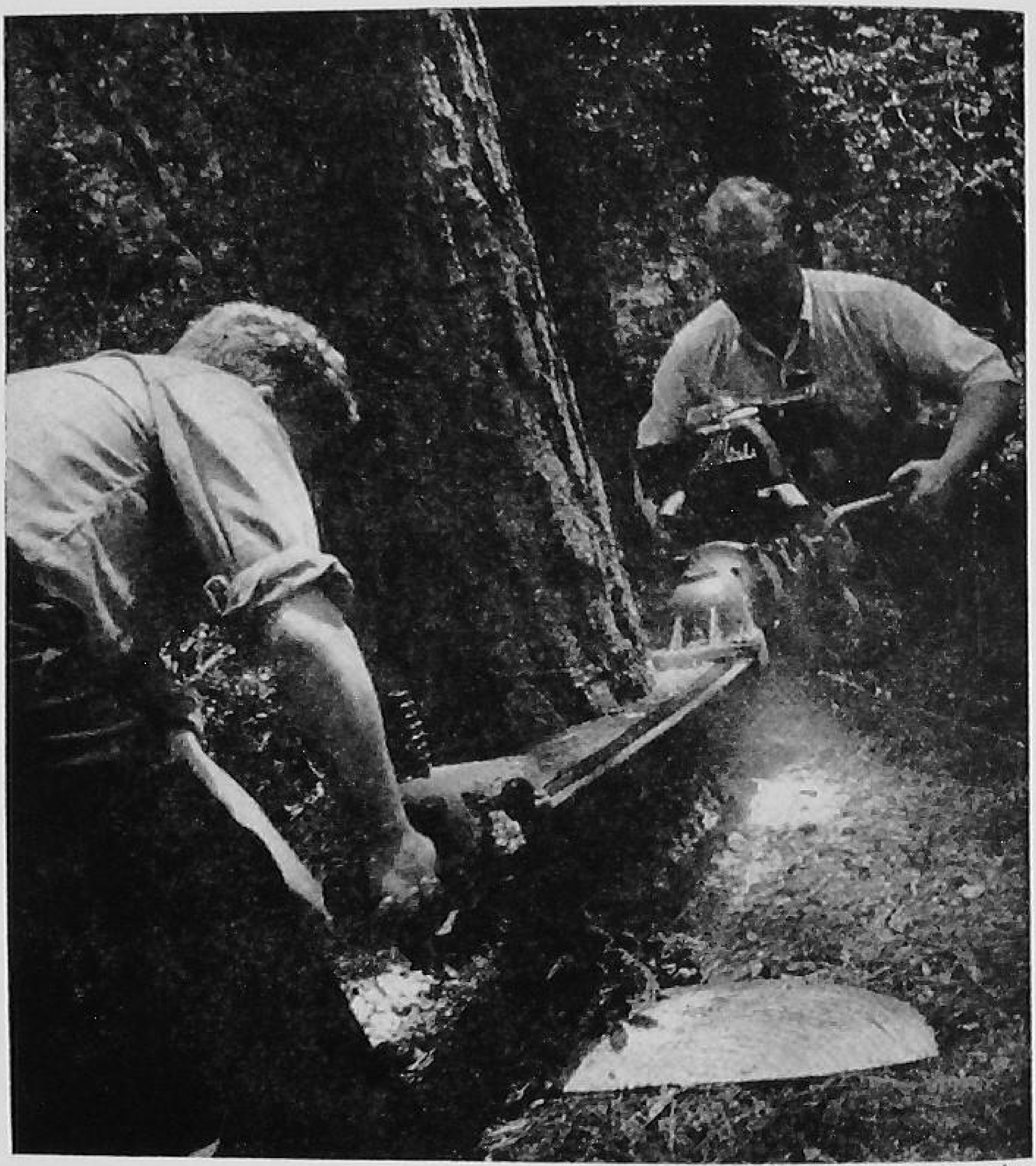
"Among the Million Pines"

The home of James Fowler—one of the nation's pioneers in the establishment of progressive forest policies

Except for a few cents per acre spent on fire protection, there had been little operation or maintenance expenses for that section of the farm covered with trees. Most of the income was clear profit.

Comparing the net returns from forest and field crops, it was not strange that a good business man should raise, in his mind, the question: *"Why would it not be good business to turn all the unprofitable land back to trees?"*

Dream Comes True.—The vision of a tree plantation that resulted from thinking about the question has become a reality. Of the 14,000 acres that James



U. S. Forest Service

MECHANIZATION COMES TO FORESTRY

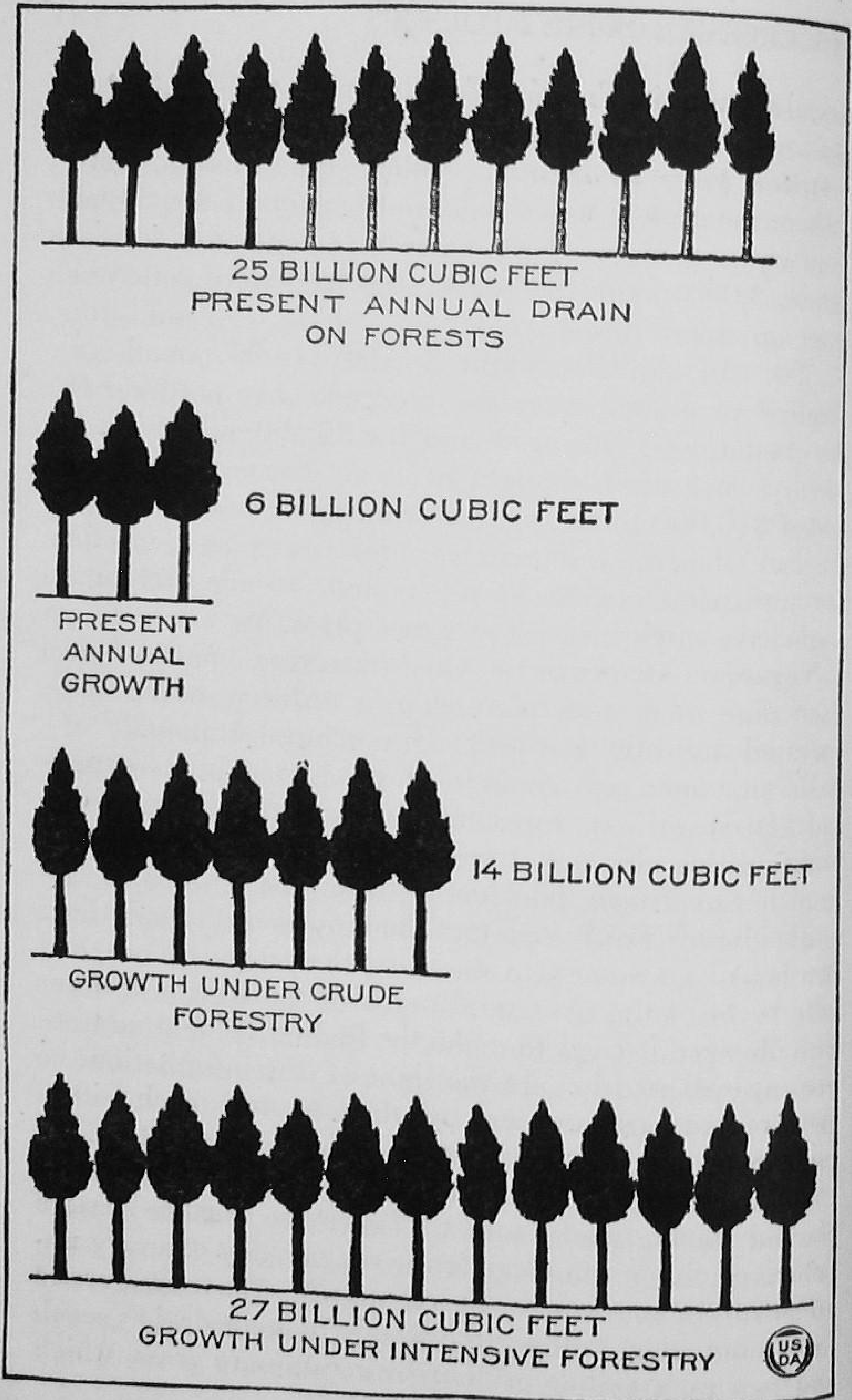
Just as such improved equipment and machinery as combines, milking machines, feed grinders, hay choppers, cotton pickers, and corn harvesters have removed much of the drudgery from general farm work, so labor-saving, power-operated tools and machines are speeding up operations in farm forestry and commercial lumbering. The motor-driven cross-cut type saw shown in this illustration is an example of how modern machines and tools make the felling of big trees an easy job compared with the hand-labor methods of the past. Today there are mechanical tools to take the place of the plow and dibble; electrically-driven saws, mounted on wheels, are replacing the ax and hand-saw in preparing pulpwood for market. Modern tools make farm forestry more appealing and profitable.

Fowler owns in Treutlin County, more than 12,000 are in trees. Cultivated fields have been converted into forest, and many of the other 8,000 acres of natural forest where the growth was thin have been supplemented with nursery-grown seedlings. He has planted a million trees. Many visitors come to see what can be done when trees are made a farm crop.

Success with timber and naval stores on a small scale prompted the tree-planting program that has been followed. Each year since changing the system of farming, additional trees have been planted. In one year, for example, 2,250 acres were planted to pine seedlings.

But although James Fowler devoted much of his time to planting trees on worn-out land, his mature forests were not neglected. Trees ready for market were cut and sold as lumber or poles. In one year 350,000 board feet of lumber was harvested; in addition, naval stores and other products were taken off the plantation.

This huge, private forest area is still in its experimental stage. Its ingenious owner learned that in certain places the oak trees, which never grew beyond scrub size, were interferring with the growth of his young seedlings. Also that the crowns of the broadleaf trees had a tendency to shade out the growing pines, and the roots of the oaks used much of the food and water which were needed to make the bodies of the pine trees strong and sturdy. In the light of this information, he secured two tractors and put them to work each with a five-man crew, pulling the broadleaf trees out of the woods, cutting them up and selling them for cordwood in one of the nearby towns. Those two tractors became efficient enough to clear ten acres per day of every undesirable tree species. In seasons when the tractor crews were not busy ridding the woods of undesirable scrub oaks, they were at work harrowing up wire grass, which


25 BILLION CUBIC FEET
PRESENT ANNUAL DRAIN ON FORESTS
6 BILLION CUBIC FEET
PRESENT ANNUAL GROWTH
14 BILLION CUBIC FEET
GROWTH UNDER CRUDE FORESTRY
27 BILLION CUBIC FEET
GROWTH UNDER INTENSIVE FORESTRY
USDA

produces an abnormal fire hazard to the young planted pine seedlings in that section of the South.

Other Tree Products.—Other forest products besides turpentine, lumber and poles may be harvested from a young, vigorous pine forest. In one year, for example, 3,000 pounds of slash pine seed were collected from an area eleven years old. This seed sold for $7,500. In addition, approximately 1,000 pounds of longleaf pine seed were gathered on other portions of the plantation. This seed sold for $2,500. Thus seed, which is not often thought of as a source of income, added $10,000 to the returns from forest products. In the year when these returns were realized, pine seed sold for approximately $2.50 per pound. Since that time seeds have often brought a higher price.

Nursery Operated.—One thousand pounds of slash pine seed were planted in a nursery owned and operated by Mr. Fowler. One thousand pounds of slash pine seed are capable of producing between ten and fifteen million trees. One dollar per thousand net profit on this number of trees would bring a return of from ten to fifteen thousand dollars. But they are not sold! James Fowler plants as many as he can on his own land, and those he cannot plant or otherwise use, he sells to his neighbors at the cost of growing. It has been determined on the Fowler Plantation that where trees are planted in such enormous numbers, that growing them at home is cheaper than buying them, even from the state nursery, where they are sold at cost.

How Seedlings Are Planted.—The seedlings are planted during the months of December, January, and February, since there is little or no danger from frost upheaval in the upper coastal plain. The abandoned farm land is laid off with a plow in rows ten feet apart and two men follow each furrow, planting a seedling

every nine feet. In this manner 473 seedlings are planted on each acre of ground. The strawberry shovel, with a straight handle and blade, was used at first, since a quantity of those shovels were available. They served the purpose of planting tools very well—so well, in fact, that the regular planting dibbles were never pur-

A Forest of Slash Pine

Planted by the vocational boys in a Georgia high school. This is the forest project of the Adrain Chapter of the Future Farmers of America. It contains 25,000 slash pines planted by the boys as an investment and demonstration

chased to replace them. Making use of the tools at hand is always a good business procedure.

Ninety percent of the trees planted have survived. Those spots in which seedlings died were planted during the next planting season so that a perfect stand resulted. Only slash pines have been planted up to the present time. If the longleaf seed now on hand are not purchased by some nursery or individual, or by some seed company, they will be grown into seedlings to be planted on the Fowler tract.

Fire Protection.—Fire has caused very little damage on this pine plantation. The surrounding landowners and farmers have become so interested in the protection of the trees that a large percentage of the land in the county has been organized into a timber protective unit and the farmers are planting thousands of

A Forest Project

A farm boy sowing carpetgrass and lespedeza

trees each year. One landowner planted as many as a hundred thousand pines in one year.

The organization owns a fire truck, which is available at all hours of the day or night. Many times it is called to duty in other sections of the county and several times it has saved homes from burning where forest fires were not even involved. The truck always carries its large water tank full and keeps its powerful pump, with its several lengths of hose, in perfect condition.

FIFTEEN MILLION LITTLE TREES

This great forest nursery in which 15,000,000 pine seedlings are produced each year is operated by the Tennessee Valley Authority. It is one of hundreds of forest nurseries in the South. Through programs of conservation, we are planting new forests each year

Part of the equipment consists of several back-pack pumps, to be used in places where the truck cannot travel.

Interesting Facts Learned.—Mr. Fowler has learned a number of very interesting things in this business of growing trees. He has learned that planted trees produce more resin than those trees which come up naturally in the wilderness and have to fight for an existence. He has learned that ten-year-old trees which average below eight inches in diameter will produce almost forty barrels of turpentine spirits per acre per year. All previous experiments have shown that trees

nine inches in diameter, growing wild, will produce only thirty barrels of turpentine spirits per crop per year, which is just enough to pay the expenses of operation.

One of the most interesting ideas gleaned from this storehouse of new information on the growing of trees is the fact that young, vigorous trees, which have no opposition from other undesirable species and are tended properly and protected from forest fires, can probably be turpentined perpetually. Dr. Charles Herty and Mr. Fowler found several trees in the stand which had been turpentined by correct methods for two years. At the end of the second year of turpentining, the face (scar) at the bottom of the tree had grown more than half over and would be ready to turpentine again in four years. Mr. Fowler thinks that with proper turpentining methods the young trees can be made to produce resin continuously without resting. He plans to place at least 2,000 more acres of his farm land in trees each year, and if he does not have enough available land to follow this policy, then to use some of the profits from his land already in trees and buy additional land. He has found from experience that growing timber does pay.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by the term *ghost town?*
2. What does it mean to say that the policy of the first saw-mill companies was to "cut out and get out"? What did this policy mean to the country in which they operated?
3. What does it mean to say "cut over land"?
4. How does the policy of the Crossett Company differ from the common practice described?
5. What does it mean to say "timber, mine or crop"?

6. What is meant by a permanent cutting policy?
7. What are some of the products made by the Crossett Company?
8. How does the making of many products save wood?
9. What stimulated James Fowler's interest in forestry. What plan did he formulate and how did he carry it out?
10. How does he plant trees?
11. How does he protect his forests from fire?
12. What products does he sell?
13. What is meant by *progressive* forest policies? How can such policies be promoted?
14. Do any industrial concerns in your community follow what you would call progressive policies? Do any individuals practice such forest policies?
15. What is meant by the word *conservation?* What are some of the ways in which we can promote interest in the conservation of natural resources?

Selected References

Collier's, June 22, 1935, If We Only Had More Towns Like This, or *Readers Digest*, August, 1935

Growing Pine Timber for Profit in the South, Misc. Pub. 24, U. S. Department of Agriculture (A portion of the story of the work of Mr. Fowler)

Suggested Activities

1. Make a list of the policies which you would classify as *progressive* which are recounted in this chapter. Divide the list into two parts. In the first, list those of the corporation; in the second, those of the individual.
2. Do you know, or can you find, any story of progressive forestry? If so, tell it to the members of your class.
3. Write a paper on the subject: *Why We Need Scientific Management of Our Forests and Forest Industries.*

UNIT II—FOREST RELATIONSHIPS

Chapter 3

FORESTRY AND AGRICULTURE

FORESTRY is closely related to farming. In fact, forestry might well be defined as *farming with trees.* Many farmers are engaged in a type of agriculture that includes *tree crops.* Some of these farmers grow nothing but forest trees; others include trees as part of a diversified production program that embraces field crops, pastures, and livestock. All farms located in sections where trees can be grown are interested in maintaining a farm forest or woodlot.

Farm Woodlands.—More than four million men and women in the United States own a small forest or wooded tract of land. The total tree-covered area owned by these American citizens, the majority of whom are farmers, embraces 261 million acres and represents more than one-half the nation's commercial forest land.

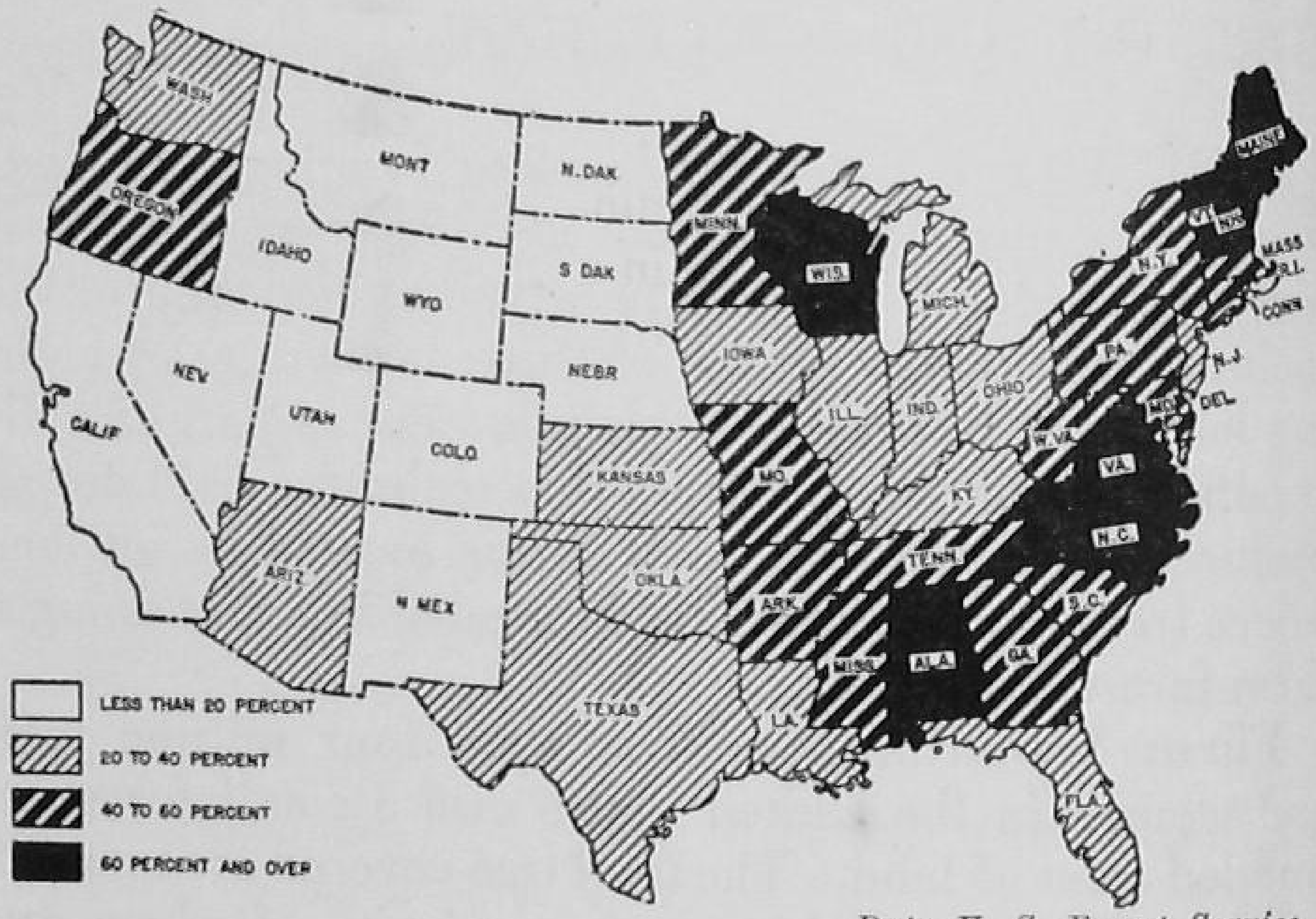
The average holdings of America's forest owners is small, only 62 acres. Seventy per cent own less than 50 acres. Only two per cent own more than 500 acres.

Farm Forestry in the South.—In the United States one farm out of every twenty is classed as a *forest products* farm. This means that lumber and forest products provide all or a major part of the farm income. In addition, there are more than one million farms that derive some income from trees and forest products.

Among the nation's farms that derive income from forests, the majority are located in the South. This fact

is revealed by a study of the most recent agricultural census from which the following statements are taken:

Woodland Pastures: The following percentages of farm lands in the several regions of the nation are devoted to woodland pastures: North, 6; South, 12; West, 7.



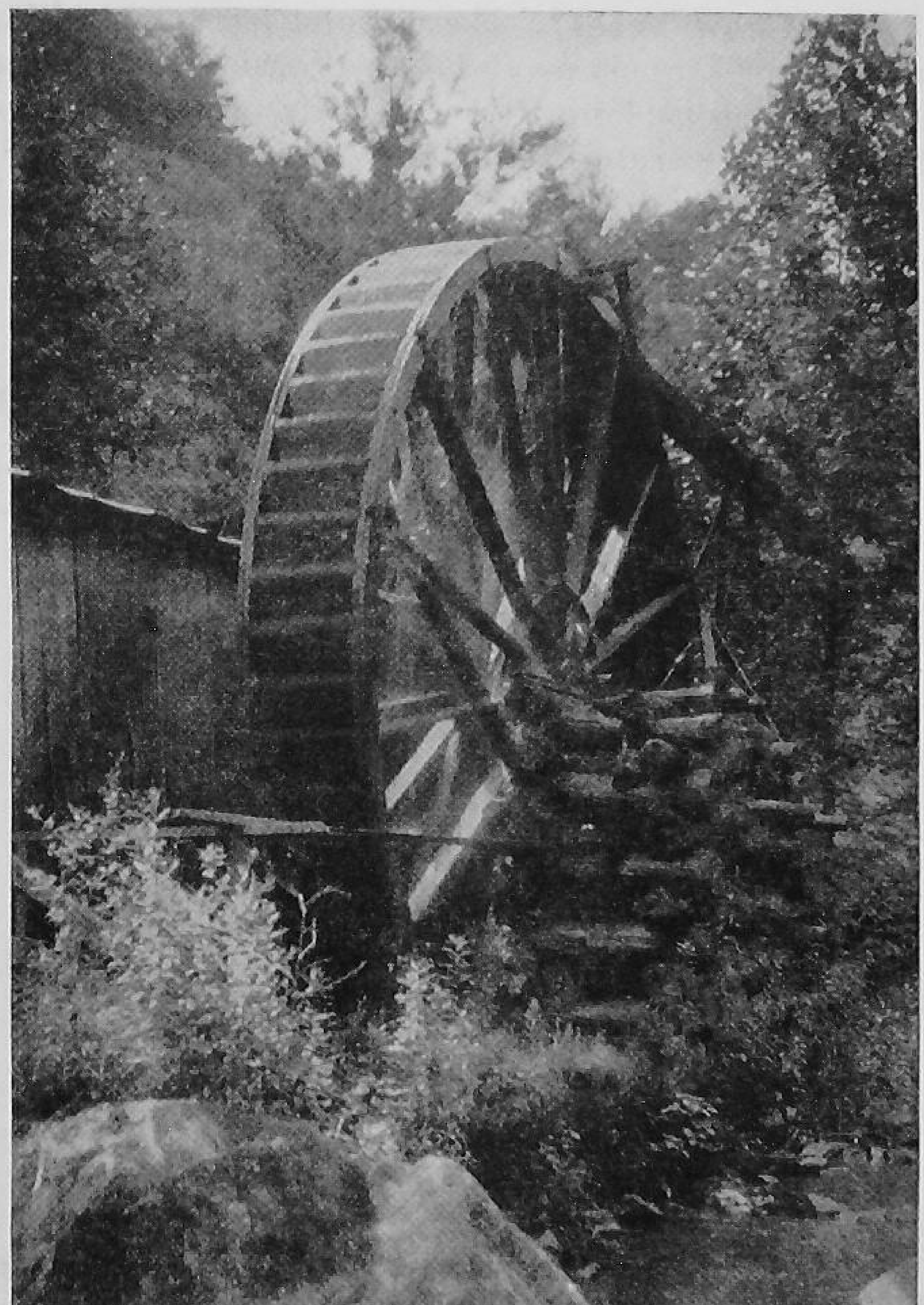
Data U. S. Forest Service

FARMS CUTTING FOREST PRODUCTS

Woodland Not Pastured: Of the woodland not pastured in the United States, the regional percentages are: North, 4; South, 12; West, 1.

Total Woodlands: Of the total woodlands on American farms, the percentage distribution among the regions is as follows: North, 10; South, 25; West, 7.

These facts reveal that farm forestry is more important in the South than in any other section of the nation. In fact, there are several states in the South in which one-half or more of the farm land is devoted to growing trees.



Courtesy Southern Region U. S. Forest Service

An Old Mill Wheel

Why Grow Trees? There are at least four major reasons why farmers may well give consideration to the growing of some forest trees in their production programs. These are: (1) *Wise and complete use of land;* (2) *production of adequate farm and home supplies;* (3) *winter employment of labor;* and (4) *increase of capital assets.* There are, in addition, a number of minor advantages associated with forest enterprises.

VETERANS RECEIVE A SHIPMENT OF SEEDLINGS

In carrying out a complete conservation program on their farms, veterans plant trees on land not suited to crop production.

Wise and Complete Use of Land.—Trees play an important part in the control of soil erosion and the conservation of water and land.

All farmers must concern themselves with the wise use of land resources. Land is the basic source of their incomes. Along with water and sunshine, land is the "raw material" out of which farmers make a living.

Through studies and investigations conducted by agricultural technicians and soil scientists, it has been found that yields of farm crops cannot be sustained if row crops are grown continuously on any field or area of land. It has been found, too, that some land is not suited to the growing of row crops. Countless thousands of acres must be devoted to the growing of grass and trees; they will not produce profitable yields of field crops.

U. S. Forest Service

Cutting Pulpwood with a Power Saw

Land with a slope of 25 per cent may not be used for tillage. For proper use, it must be devoted to grass or trees. This is known as *Class C* land.

Land having a slope of 35 per cent or more is too steep to control erosion unless forested. This is known as *Class D* land.

But there are, in addition, millions of acres of fairly level land that are best suited for the production of for-

Only Trees Should Be Grown Here

Trees were protecting this 40 per cent slope and making good use of it, but man in his greed for more crop land and for timber or wood has cut over many such areas. It is too steep for cultivation, and what now looks like good "new-ground" soil is likely to wash away and leave an area of devastation and destruction

est trees. Much of this land is now idle; it is producing no income for its owners. Much of this land is sandy; it is not productive enough to justify the labor and expense involved in growing field crops. Some of it is covered with broomsedge, brush, or scrub oaks. These plants have little or no value, but most of these lands might—through a wise land utilization or resource-use program—be devoted to the growing of pine trees for which there are unlimited demands.

Water is also a factor to be considered in the use of land. Few persons realize, for example, that 100 pounds of water are required to grow one pound of corn. Water, more often than not, is the limiting factor in crop yields per acre. When it rains, water, muddy water,

pours off barren and cultivated fields carrying, of course, not only plant food but the soil itself. Planting trees will control the run-off of water. This saves soil and plant food. It aids production on the entire farm, and, naturally, it increases growth-rate within the forest or wooded area.

Conservation farming demands, in tens of thousands

A SOURCE OF FARM INCOME

Each year the railroads of the nation spend millions of dollars for crossties

of cases, that farmers give consideration to the planting and care of trees.

Farm and Home Supply.—Forest trees, like home gardens and orchards, must be classified as farm and home supply crops.

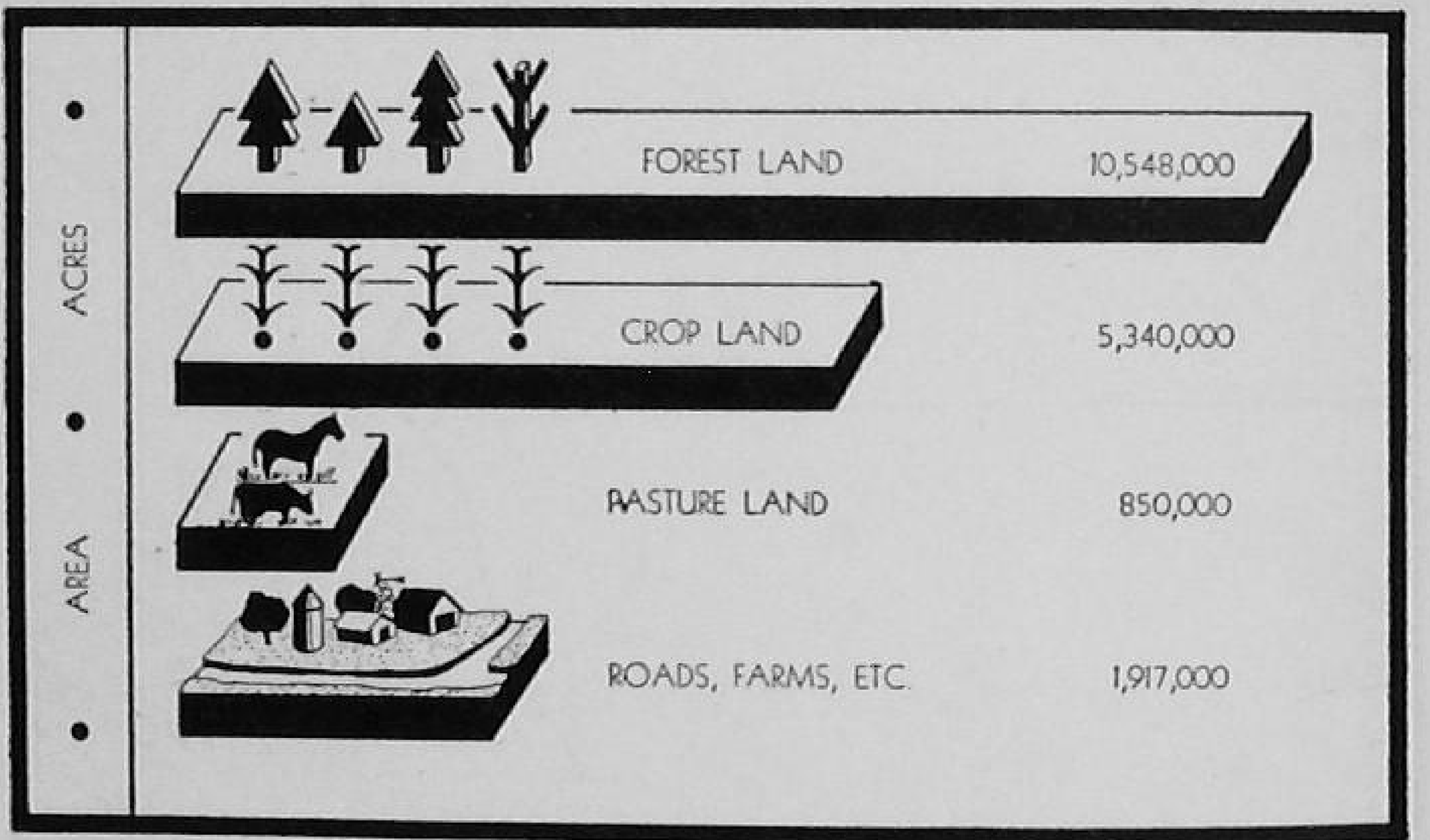
Farmers need lumber for barns and buildings, posts for fences, and fuel for fires. The farm forest or woodlot will supply these needs.

Often, when farmers need lumber, sawmill operators will provide it and take their pay in lumber. Such a

plan will enable a farmer to meet his lumber needs without the outlay of any cash.

Winter Employment for Labor.—Farmers make money in three ways—from wise management; from capital investment in land, buildings, equipment, and livestock; and from labor.

Farmers who grow only field crops do not provide the maximum number of income-producing days of labor in



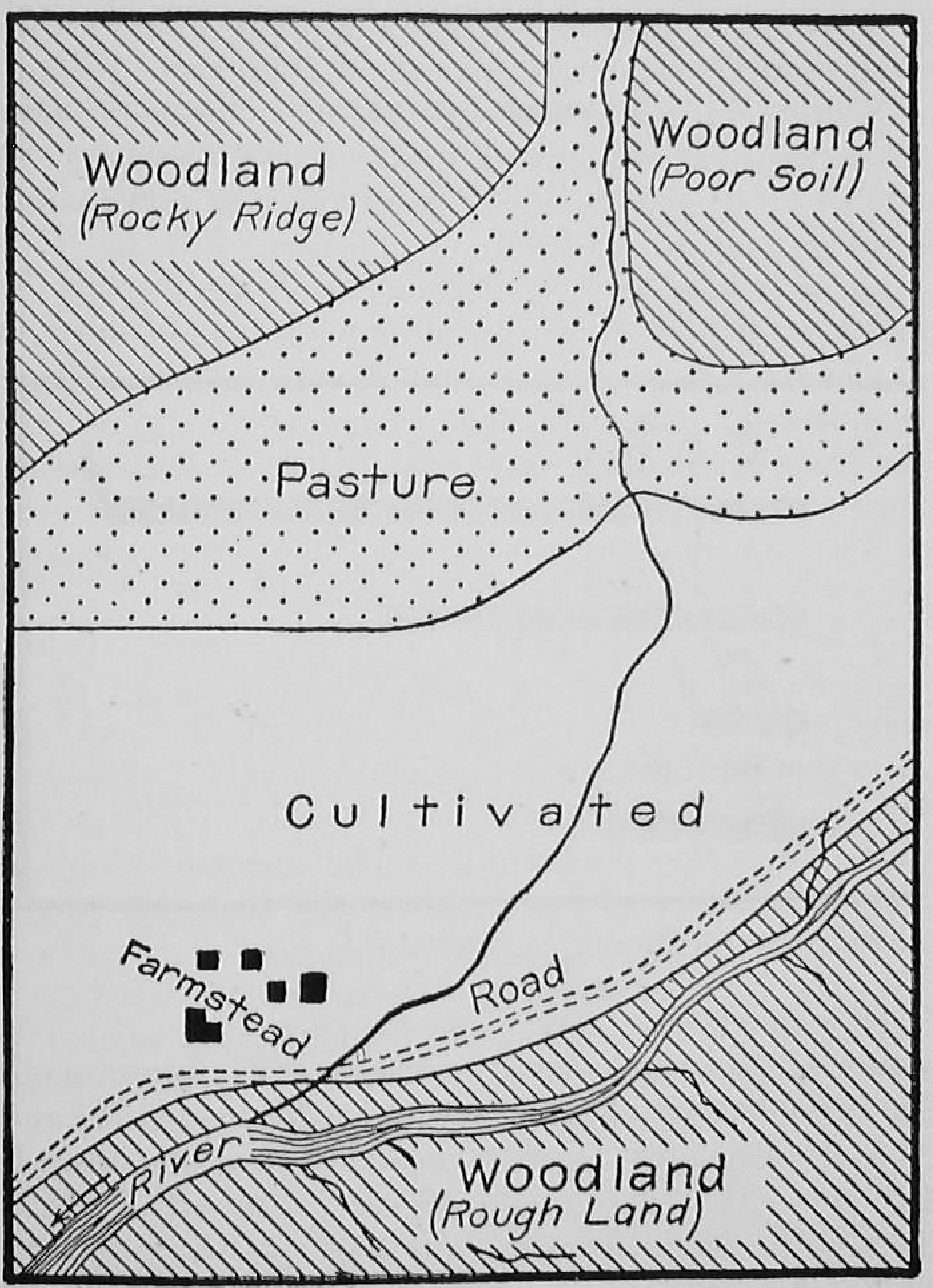
Courtesy Texas Forest Service

East Texas—One-Half Forest

Land use in acres

a year to earn satisfactory incomes. It has been found, for example, that 75 per cent of the work in growing and harvesting cotton falls within a period of six months. It is higher—85 per cent—in the case of tobacco. High-income farmers provide an all-year work program. Many use winter work with trees to supplement the spring-summer-fall work with crops. For many farms such a program is the most efficient that can be followed.

Trees as Capital Assets.—What is meant by the expression *capital assets?* How may trees be regarded as capital assets?



THERE IS A PROPER USE FOR EVERY ACRE

This map, which has been taken from Farmers' Bulletin No. 1117 of the United States Department of Agriculture, shows that there is a proper, or best use, for every acre on the farm. The steep hillsides, the poor soil, the rough land, and all that is badly eroded, should be planted to trees

These are questions well worth thinking about. Many young persons who have entered the business of farming or plan to do so may find the answers to these questions very important in planning for their future welfare.

The word asset is defined as *any item of value that is owned.* Capital, as used in connection with the word asset, is defined as *a stock of accumulated wealth.* To make the definition of capital easier to understand, the dictionary also states that *capital is the amount of property owned by an individual or corporation at a specified time, as distinct from the income derived or received during a given period.*

What do these definitions mean? Let us consider a specific example that relates to farming!

A farmer owns, let us say, 200 acres of land. He also owns some buildings—a barn, a poultry house, and a machinery shed. He owns, in addition, livestock and farm equipment. All these "items of value" constitute his capital, or his "accumulated wealth." This wealth or capital makes possible his annual income. And, by selling a portion of his wealth at any time, his annual income may be increased. Or, if his assets become more valuable from year to year, his wealth is increased.

But how are assets, capital and wealth related to trees? The answer is very simple. Let us consider an example that relates to farming!

A farmer owns a tract of land devoted to the growing of trees. The land is an asset; so are the trees. Each year, if cared for properly, the trees grow and, as a result, become more valuable. Thus the capital assets of the owner increase.

How trees may be used by farmers to increase capital assets is the subject of an article written by Don Colmer that appeared in the publication *Mississippi Forests and Parks.* The title of the article, which follows, is:

FARMER INSURES HIS OLD AGE WITH SILVICULTURE:

Ben Pickett, Scott County farmer, has the best old-age insurance in the world. He owns 160 acres of timber lands four miles north of Morton, and by careful management he has developed this tract of pine timber into a steady source of income that will carry him comfortably through the coming years.

Mr. Pickett, a native of Scott County, bought 150 acres of land four miles north of Morton about twenty years ago. At that time most of the land was covered with young pine timber. With the help of his neighbors he cleared much of the acreage and attempted to farm it; but he later decided that most of the land was more suited to the growing of timber than for farming and let old mother nature take over.

He now has one of the finest tree farms in the state. As evidence of his good judgment, Mr. Pickett recently sold ten acres of this timber to a contractor for $2,000. The ten-acre plot that he sold was just an ordinary pine thicket when Mr. Pickett acquired the land.

Mr. Pickett says that the quality of the timber on his lands is no accident. He has carefully thinned and pruned his trees through the years for maximum growth.

In the fall of the year, preferably after the middle of October, Mr. Pickett takes his axe and pruning saw and goes systematically through his pines, thinning the young, thick growths and pruning the larger trees carefully. Asked if a certain stand of sixteen-year-old trees was not too thick, Mr. Pickett replied that as long as the trees continued to grow steadily, they were doing all right.

His system of pruning young pines gives Mr. Pickett straight, clear high quality timber that makes the mouths of pole and timber buyers water, and probably accounts for the fine price of $2,000 that he received for a ten-acre stand.

Mr. Pickett showed the reporter a large tract of pines that appeared to be about fifteen years old. Scattered throughout this tract were several big trees that were obviously much older. Mr. Pickett pointed out that he let a fire get away from him sixteen years ago while clearing up some new ground.

The fire completely destroyed about twenty acres of timber, with only a few of the hardier trees surviving. "This is the only fire I ever had," Mr. Pickett said. "It was caused by my own carelessness."

Asked how he managed to keep his timber free from fires, Mr. Pickett said that he had roads on two sides of his lands that acted as fire lanes and that he had good neighbors on all sides. They too believe in fire protection and control, Mr. Pickett said.

Noting a fine stand of young trees (about 12 years old) while walking over his property, we asked Mr. Pickett about it and he said that it was his old cotton patch. He cleared and burned the timber from this ten acre plot about twelve years ago, raised a bale and a half of cotton, and let it go back to trees. It reseeded itself and now is one of the finest stands of young timber in Scott County.

We stood in a section of younger pines to view this old "cotton patch" and noticing the unmistakable furrows in the sod beneath our feet, we asked Mr. Pickett about this. "This is my old watermelon patch," he stated. This old "watermelon patch" is now covered with pine from one to nine feet high.

Asked why he prunes his timber in the winter, he stated that during this season of the year, borers or pine beetles would not attack it. By the time warm weather comes the scars are calloused and the limbs are sufficiently decomposed so as not to attract these insects.

In addition to raising timber as a crop, Mr. Pickett has thirty-two fine head of red polled herefords, enough corn and hay to get them through the lean winter months. A flock of chickens and ducks provide him and his wife with eggs and an occasional chicken dinner.

Mrs. Pickett has canned hundreds of jars of vegetables which assures them of the finest fare during the winter months.

The pines about the farm house are full of big red fox squirrels, but Mr. Pickett says he has no time for hunting or fishing. Quail also abound on his acres.

Mr. Pickett is content to take care of his timber, because as he so aptly states it, his timber is taking care of him.

Trees as a Crop.—Farmers who grow trees will do well to think of them as a *crop*. This means that, like other crops, trees may be planted. It means, too, that, like other crops, they may be harvested annually. To harvest trees annually means that a wise cutting policy must be followed. Such a policy means, for example, that unprofitable trees will be removed; that parts of the forest may be thinned; and that not too many will be cut at any one time.

Wise cutting on large tracts means that the same amount of timber is cut in any one year that grows in one year. This is called cutting on a sustained-yield basis. Following such a policy will maintain, rather than deplete or destroy the forest.

On a demonstration forest at Crossett, Arkansas, it has been found by keeping records over a period of years that sustained-yield cutting is practical on a farm forest of 40 acres. Records for a ten-year period showed that about $15 worth of wood could be harvested each year from the tract without reducing the value of the standing timber; in fact, the volume of timber increased over the decade as a result of following a wise cutting policy.

Few farmers apply wise harvesting methods. The Texas Forest Service, for example, found in a study of timber cutting practices that good and better practices were followed on 96 per cent of public owned forest land; good and better practices were followed by owners of large tracts; but on the small holdings poor and worse practices were practiced on 87 per cent of the land. On this land, owned almost exclusively by farmers, good and better practices were applied only on one per cent of the land.

Such facts, which are typical of those recorded in states other than Texas, show that farmers should study

forestry and give more thought to the proper management policies.

Marketing Timber.—Marketing timber is not so simple as selling hogs, cattle, or cotton. Often farmers do not know how much timber they have to sell or what it is worth. But in solving such problems farmers may call upon their state forest services. The following statement published by the Virginia Forest Service shows that the Service will SELECT and MARK trees to be cut and ESTIMATE THEIR VOLUME:

Constructive forestry legislation enacted by the General Assembly enables the State Forest Service to actively encourage the use of sound technical principles in the harvesting of the state's vast crop of forest products.

The purpose of the Act is to provide trained technical forestry assistance to forest landowners in the voluntary use of sound forestry harvesting principles, by removing the ripe and defective timber, leaving the choice, thrifty, unripe trees and providing for immediate reproduction of desirable tree species.

Upon the receipt of a voluntary request from a forest land owner for assistance, a State Forest Service representative will accompany the owner to the timber tract, make a general inspection, discuss the condition of the timber and make recommendations concerning desirable forestry practices. There is no charge for the general inspection and recommendations.

In those cases where the owner so wishes and authorizes, the forester will work over the tract, select, mark the trees, and estimate the volume to be removed, whether it be lumber, pulpwood, ties, or other forest products. The forester will furnish the owner a written report of the number of trees marked and volume estimated. The owner can then contact known forest product operators in the community and advise them of the timber he has for sale. The actual negotiation of the sale and sale price is a business matter between the owner and buyer.

The Forest Service will not make a cruise of a timber tract for the purpose of estimating the volume alone, as the timber could then be sold without the assurance that forestry methods

would be used in harvesting the timber on the tract. The fundamental purpose of the assistance rendered is to procure the use of sound forestry principles.

For the technical forestry timber marking services rendered, the owner agrees to pay the Forest Service, a small fee per thousand board feet of timber marked, or a comparable amount per unit of other products designated.

The Virginia Forest Service says to tree owners, "Do not sell a 'pig in a poke.' The pig may be bigger than you think!"

SUGGESTIONS FOR STUDY

Questions and Problems

1. How many people own farm woodlands? What is the average acreage owned by each person?
2. Give three reasons to show that farm forestry is more important in the South than in other sections of the nation.
3. Give four reasons why farmers may be interested in growing trees.
4. What kinds and types of land are suited to tree growing?
5. How do trees help to conserve soil and water? Explain.
6. How are trees useful as a farm and home supply crop? Give examples.
7. Discuss trees and the winter use of farm labor.
8. How many trees aid in the accumulation of capital assets?
9. Tell the story of the farm woodlands of Ben Pickett.
10. Why may trees be classed as a farm crop?
11. What is meant by sustained-yield cutting?
12. Discuss the demonstration forest at Crossett, Arkansas.
13. Why are trees more difficult to market than pigs or cotton?
14. What assistance does the Virginia Forest Service offer owners of forest land?
15. Discuss the relationships of forestry and farming.

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1117—Forestry and Farm Income
1177—Care and Improvement of Farm Woods
1453—Growing Coniferous Trees on the Farm
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24—Growing Pine Timber for Profit in the South
87—Profits from Farm Woods
247—Forestry and Permanent Prosperity
357—Southern Pines Pay

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29—The Farm Woods
30—Cutting Farm Woods Profitwise

State Publications

Florida—Circular 2—Planted Pines Pay
Georgia—Bulletin 446—Forest Management in Georgia (College of Agriculture, Athens)
Mississippi—Mississippi Forests and Parks, Mississippi Forest Commission, Jackson
Tennessee—Circular 13—Forestry for Farmers
Texas—Bulletin 42—Texas Forests, Texas Forest Service, A. & M. College, College Station
Virginia—Bulletin 276—Marketing Woodland Products in Virginia

Suggested Activities

1. Make a study of the farms of your community to determine what per cent of them devote a portion of their land to the growing of trees. If possible, determine the average acreage per farm and the type and value of products sold.
2. Make another survey to determine the jobs involved in farm forestry and the month of the year when each is done.

Chapter 4

FORESTRY AND SOIL CONSERVATION

ON THE afternoon of May 12, 1934, something new and unique in the annals of American history took place.

The members of the Congress of the United States were discussing the problems of the nation, seeking ways to improve the economic condition of our people, when suddenly the sky was overcast, and it became dark in the halls of the national capitol. Senators and Congressmen hesitated in their deliberations. They wondered what was taking place. Was it an eclipse of the sun?

It was a dust storm.

Let Dr. H. H. Bennett, chief of the Soil Conservation Service, U. S. Department of Agriculture, give his impressions of this phenomenon: "Interest in soil erosion control was greatly increased on May 12, 1934. On that day, for the first time since the white man came to America, a great dust storm, originating in the plains country just east of the Rocky Mountains, drifted two thousand miles to blot out the sun over the nation's capitol, and hundreds of miles out over the Atlantic Ocean. When particles of soil, driven from the heart of the nation, grated upon the teeth of city people along our eastern seaboard, these people realized that something had gone wrong with the agricultural domain in the West."

A Man-Made Desert

In a land of ample rainfall, this man-made desert was made at Ducktown, Tennessee, by the escaping fumes of an industrial plant. It illustrates how dependent we are upon plant life and how the soil is destroyed through erosion once it has no vegetative covering. All of our land should be devoted to the growing of plants, and all land with a steep slope should be planted either to grass or trees

What was it that had caused the dust storm?

It was *wind erosion* which meant that the soil on the western plains was being lifted by the wind and carried to all parts of the nation. It meant that the soil, which is the basic resource of mankind, was being destroyed. It meant that fertile soil from farms was being blown away; that buildings and homes were being covered with soil particles; that the wealth of a nation was being destroyed.

Why was this waste taking place?

Because there was no vegetation on the land to hold the soil in place. And because there had been less rainfall than usual in the western states for a period of two or three years. It meant, also, that we had given little or no thought, as a people, to the conservation of

WE MUST STOP THIS LOSS OF RICH LAND

Millions of acres of land in the South will look like this canyon in the years ahead unless we take the necessary steps to control erosion. This can be done by devoting more of our land to close-growing crops like grain and hay, to pastures, and to trees

the land. It meant that we did not fully comprehend the menace of soil erosion.

What is *soil erosion?*

Soil erosion is the mechanical movement of soil from one place to another. It comes about through the action of wind and water.

In some sections, where there is little rainfall, as compared with the eastern part of the country, wind erosion is serious. Due to over-grazing of the land, and other like causes which reduced the amount of vegetation on the land, the dust storms followed a period of drought. But wind erosion, to a lesser degree, had been taking place for years.

In some sections people have little to fear from wind erosion. Where the rainfall is great and plants grow luxuriantly, there is little blowing of the soil. But in the sections that escape wind erosion the worst erosion conditions in the entire nation exist. These conditions are due to the movement of soil by water.

There the very heavy rainfall washes the land badly.

WIND EROSION

Wind erosion occurs in that part of the nation where there is neither trees nor grass to hold the soil. This soil has, during severe droughts, been blown more than half way across the United States

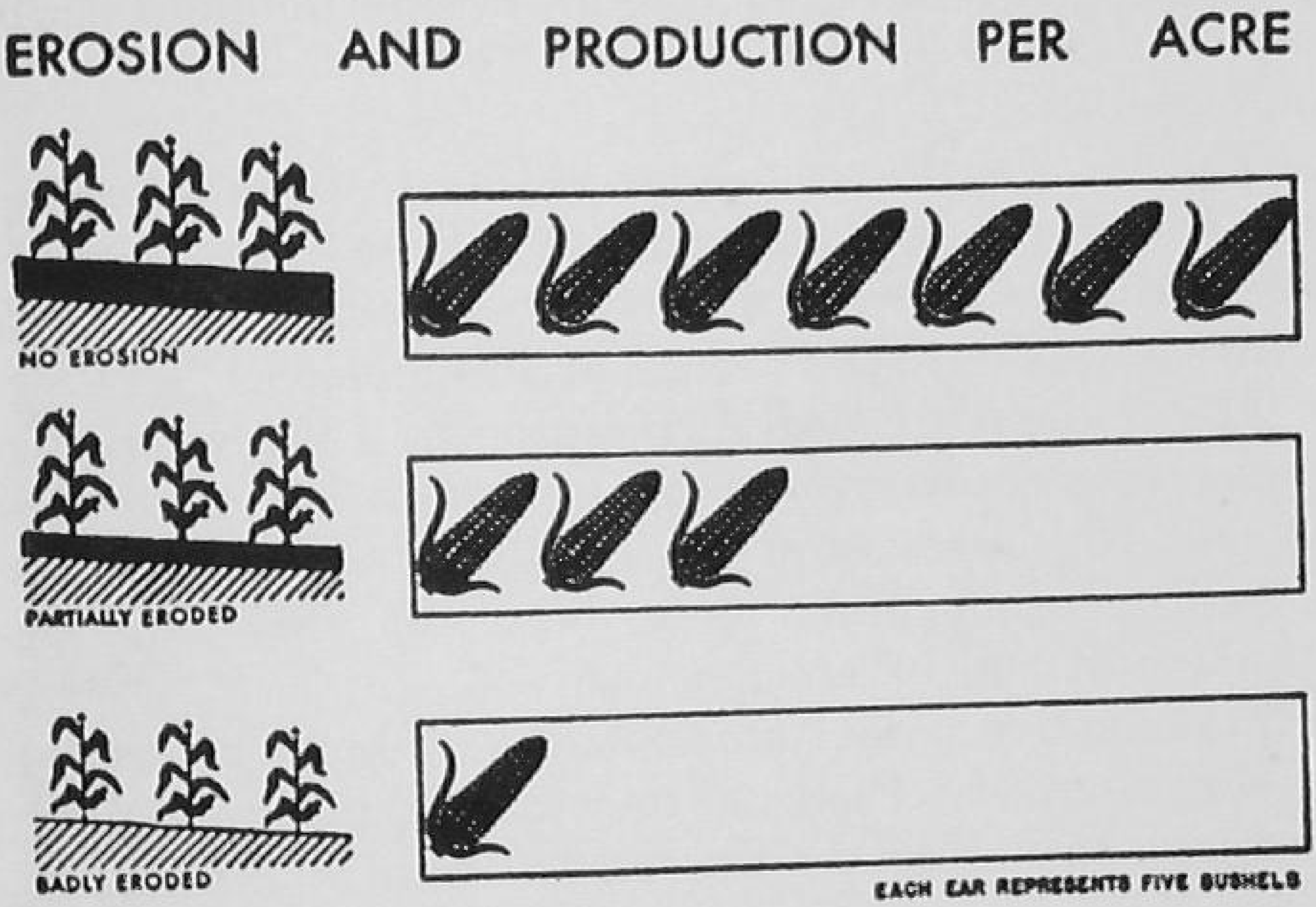
Rain has created vast gullies and small canyons. It has completely ruined thousands of farms. It has rendered utterly useless millions of acres of once valuable land. Some of this land can be reclaimed, but millions upon millions of acres are gone forever—washed into the sea.

What is the explanation for this enormous loss?

Water, you know, tends to seek its level. This means that when water falls on any surface it runs downhill. As it runs it carries soil with it.

After a rain, water begins to run. It runs through fields and pastures and forests.

To stop the run-off of water, farmers have built terraces on their land. But these terraces have not always been effective. They have permitted water and soil to run over the fields. As a result, the best top soil,



PROFITABLE YIELDS OF CROPS CANNOT BE GROWN ON ERODED SOILS

Steep hillsides, rough land, and all land on which low crop yields are made, should be planted to trees. All the land now "lying out" should be planted to trees or to grass. There should not be one idle acre in the South

which is the most fertile, has washed away and left only the poorer sub-soil as the home for plants. This process of waste, taking place year after year, has reduced the crop yields per acre, and has reduced the profits from farming, for large yields and large profits always go together. Our yields in the South are lower than those of any part of the nation.

It is a well-known fact that the majority of the South-

ern people are engaged in farming. It is also well known that we do not feed ourselves; that we send to other states and other sections to buy the food and feed products we require. We do not produce enough to meet our own needs. It has been pointed out that some of our states with their present yields per acre and their large populations cannot become self-sustaining for the reason that not enough food and feed can be produced on our farms.

The limiting factor in our ability to feed ourselves and have a profitable agriculture will be determined by our ability to improve the fertility of our lands, which means, first of all, the control of soil erosion.

The Extent of Soil Erosion.—In 1492 when this continent was discovered by Columbus all of it was covered with forests and grass. At that time, except for a small area of waste land, there was very little destruction of soil by erosion.

In the native state, Nature provided for the protection of her resources. Plants as they grew to maturity, died; and with falling leaves littered the floor of the forests. These dead plants, as well as the carcasses of animals, returned organic matter to the soil to provide nourishment for new generations of plants. There was a perfect and uninterrupted cycle. Fertility was maintained through the restoration of organic matter; erosion was controlled by the vegetation on the forest floor.

But man came in and cleared away the forests. Row crops were cultivated. Plants were removed from the land. Leaves and grass and brush were burned. The land was left uncovered, and, as a result, water ran off quickly and carried soil with it.

This process of man-made conditions led to the loss of soil and water, and to the destruction of once fertile fields.

THE FOREST FLOOR

The leaves and other litter check soil erosion

"Thirty-five million acres of land have been essentially destroyed in this country," we are told by specialists in the U. S. Department of Agriculture. "This is an area as large as Pennsylvania, Massachusetts, and

Connecticut combined. But the total loss of this land represents but a small part of our problem of soil conservation. Of the 350,000,000 acres now under cultivation, about 125,000,000 acres are being washed away through sheet erosion. 100,000,000 other acres are being washed so that in time a sub-soil will be exposed which is ten times less productive than the

ONLY TREES WILL RECLAIM THIS LAND

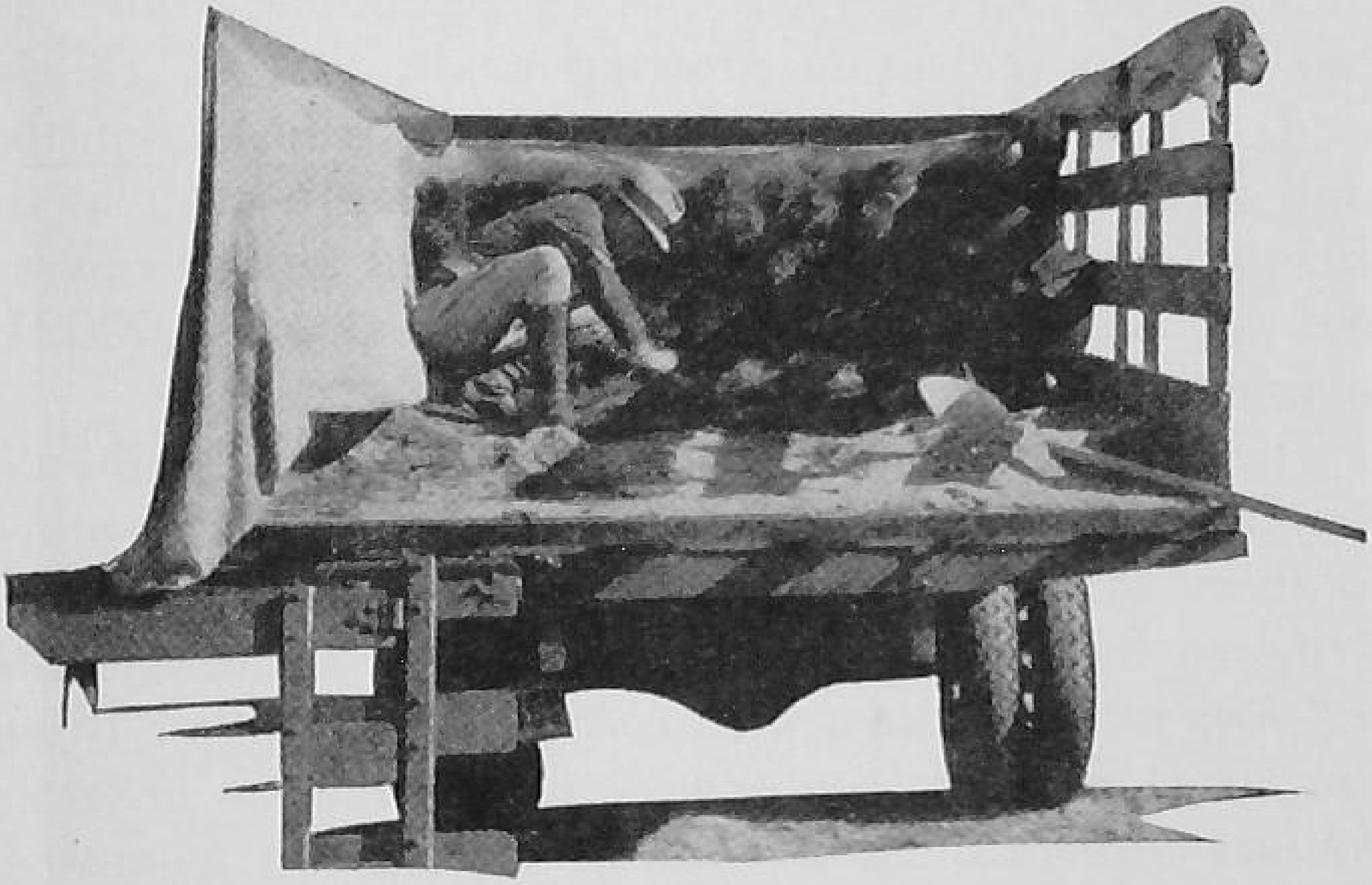
Land from which the rich topsoil has been washed away can be reclaimed and made valuable only through the planting of trees

surface soil, which is yet available today. *Faster than any other people of the world, we have been permitting the depletion of our agricultural lands.*"

Soil Conservation Service.—Just as the Federal Government has made provision for preventing and controlling forest fires, so it has created an agency charged with the responsibility of controlling soil erosion. This is the Soil Conservation Service of the U. S. Department

of Agriculture. This agency was created shortly after the dust storms of 1934. Through the Service, soil erosion control projects have been located in all the states of the nation and experiment stations have been created for the study of erosion control.

Under the provisions for aid made possible through the Soil Conservation Service, it is now possible for the



FOREST SEEDLINGS

Farmers in Soil Conservation Districts plant millions of trees

citizens of any watershed to form a *soil conservation district* and unite in an effort to control soil losses.

Other agencies, including the state forest services, the agricultural extension service of the land-grant colleges, and the departments of vocational agriculture, are aiding in the control of soil erosion. As a people, we are aroused to the seriousness of this soil waste and we expect to stop it. Every farmer and landowner must help.

But what is the relation of forestry to soil erosion control?

How Forests Prevent Erosion.—*Trees, better than any other land covering, control water run-off and consequently the loss of soil.*

Practically no soil erosion takes place in a forest.

At Statesville, North Carolina, an experiment was conducted for a period of five years to determine how much soil was lost from an acre under different uses. It was found that each year 64.6 tons were lost from land that had no vegetation growing on it, that is, fallow land; that 22.6 tons of soil per acre were lost when the land was planted to row crops which were cultivated; that on land in grass, the loss was .0012 tons per acre; and that on virgin woodland, the loss was only .00021, or practically nothing.

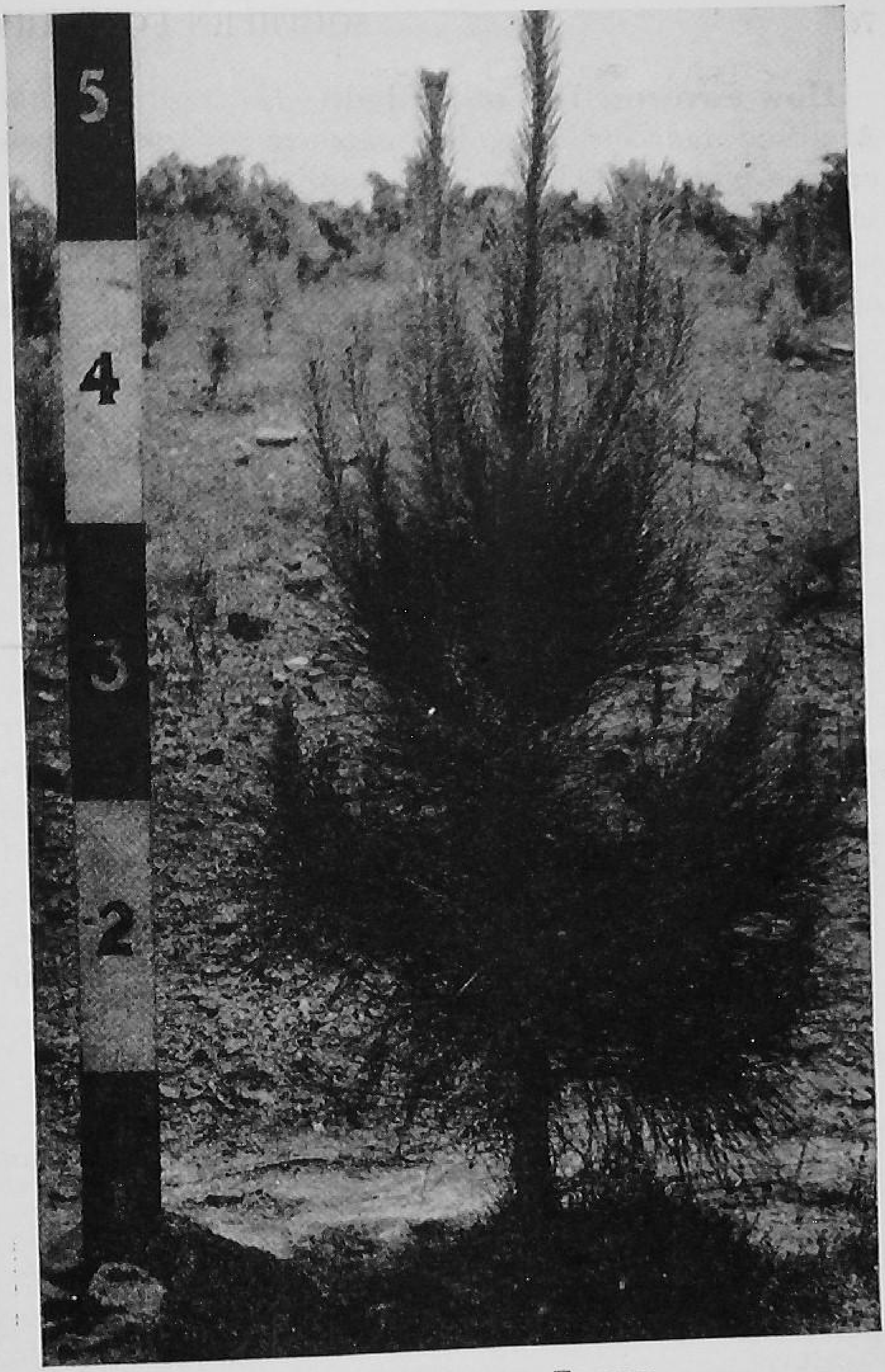
The facts obtained in North Carolina have been substantiated by similar experiments conducted in other southern states. For example, in Alabama it was determined by the Alabama Polytechnic Institute that *the soil loss on land planted to cotton* (or any other tilled row crop) *is more than one thousand times as great as the loss on land in forests that were protected from fire.*

The results of the Alabama experiment are given in the following table:

Forests Prevent Soil Erosion

Unburned Woodland Saves More Water and More Soil Than Any Other Land Covering Known

Crop	*Loss Tons of Soil Per Acre*	*Loss Per cent of Rainfall*
Cotton	26.7	14.0
Wheat	1.8	13.0
Sweet Clover	0.72	9.2
Bermuda Grass	0.04	1.5
Woods	0.02	0.14
Woods Burned	0.22	5.1



Pines Will Control Erosion

This two-year old slash pine tree on a badly eroded slope has developed a good root system to check erosion and is already beginning to form a blanket of needles and other litter around it to further hold and improve the soil

How Erosion Is Controlled.—The results of the Alabama and North Carolina experiments suggest how erosion is controlled. It is accomplished in the following ways: (1) through the proper use of the land; (2) by constructing good terraces; (3) by growing crops in a rotation; (4) by growing noncultivated crops; (5) by

TREES WILL HOLD THE SOIL ON THIS HILLSIDE

The coarse sand on this hillside will be held in place by these pine trees and, in time, a fine productive soil will be formed. We must plant more trees and grass in the South to prevent the erosion of our soil

devoting certain lands to pasture; (6) by contour planting; (7) by keeping the land covered with something growing at all times; (8) by turning under vegetative matter.

The Correct Use of Land.—In the control of soil erosion, the correct use of the land is very important. This means that there is some land which is well adapted to one purpose but not well suited to another.

Let us consider an example!

A steep hillside should not be planted to cultivated crops. It should be planted to grass or trees, depending upon the degree of slope.

The greater the slope of the land, the greater the erosion—under the same conditions. For this reason, scientists who are studying the problems of erosion control have attempted to classify land on the basis of its slope. In this way they can aid us in determining the uses for which land is best adapted.

Below is given such a classification, which is important for the reason that it helps us determine how to use the land we have. In this case, we are interested primarily in learning that land with a steep slope should be planted to trees. Much of the land in cultivation in the Piedmont Region of the South should be planted to trees and grass, rather than to cultivated crops. When such land is planted to corn and other tilled crops, it erodes badly, and it is difficult, if not impossible to main-

THE PROPER USE OF LAND

Slope Is Important in Land Adaptation

Slope Class	*Slope*	*Adaptation*
A	0–5 %	Little or no control measures necessary.
B	5–15%	Recommended for planting if strip-cropping and contour planting is followed.
BB	15–25%	Recommended primarily for close-growing crops such as grains and hay. May be used for crop land for cultivated crops, but must be well terraced and the strips must be very narrow.
C	25–35%	Not for tillage. May be used for trees or for pastures.
D	35%	Too steep to control erosion unless forested.

tain its fertility. Under such conditions crop yields are low, and, generally speaking, unprofitable.

From the preceding classification of land, and from the experimental results previously given, it is shown that forests control erosion better than any other land covering.

Much of the land now in cultivation in the South should be planted to trees. This includes (1) land on the steeper slopes; (2) land that is badly eroded already; (3) waste land that has already been destroyed by erosion; and (4) land not capable of now producing profitable yields of cash crops.

In the soil conservation districts formed under permissive national legislation, specialists from the U. S. Soil Conservation Service will make a map of every farm showing how each part of it should be used. There is scarcely a farm in the United States on which there is not some land which should be planted to trees.

Badly eroded land should also be planted to trees. This is one of the most effective ways of preventing further erosion and restoring the fertility of the land. Trees should be planted in gullies.

In the work of the U. S. Soil Conservation Service, forestry has played an important part. The Service has started, and now maintains, dozens of great forest nurseries on which millions of seedlings are produced each year. They have done much to carry forward the work of reforestation. In these nurseries both pines and hardwoods are grown. The Service has grown millions of black locust seedlings. They have found this tree most effective in stopping gullies.

There is a very close relationship between forestry and soil conservation. Our soils cannot be saved without trees. They are Nature's best protectors of the soil —our greatest natural resource.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is soil erosion?
2. What are the elements which produce erosion?
3. How many kinds of erosion are there?
4. What is a dust storm? Why did they occur? In what part of the country?
5. Will the Southeast, in your opinion, ever have dust storms? Why?
6. Why is soil erosion so important?
7. Why must soil erosion be controlled?
8. Why is water run-off important in the Southeast?
9. How may erosion be prevented?
10. How has our system of farming contributed to soil erosion?
11. Why was there little or no soil erosion before the white man came to North America?
12. What is Nature's way of preventing erosion?
13. How is erosion related to land use?
14. Would more erosion occur in a cotton field or in a field of grain? Why? In a forest, or in a pasture?
15. What is the relation of erosion to slope?
16. What land is naturally best adapted to growing crops, bottom land or hill land?
17. What land should be planted to trees?
18. What is the Soil Conservation Service?
19. What agencies are working to prevent the erosion of the land? What does each do?
20. Discuss the relation of forestry to soil erosion control.

Selected References

Books

Bennett, H. H., The Soils and Agriculture of the Southern States, Macmillan Company.

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General Bulletins

Little Waters, T. V. A., Knoxville, Tennessee.

Soil Erosion Control, National Resources Committee, Washington, D. C.

Saving Our Soils, Public Affairs Committee, 8 West 40th St., New York. (ten cents.)

U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletin 1767—Soil Defence in the Piedmont.

Misc. Pub. 253—Conservation Farming Practices and Flood Control.

Farmers' Bulletin 1234—Gullies: How to Control and Reclaim Them.

Soil Conservation Service, Soil Conservation, (A monthly magazine)

State Publications

Every College of Agriculture has numerous bulletins dealing with soil erosion control which they will gladly send to any individual on request.

Suggested Activities

1. Make a field trip through your community to observe soil erosion conditions. Before starting on the trip make out a list of questions that you will attempt to answer. Suppose one of the questions is—How is erosion related to slope? List at least nine other questions. Record the answers after returning from the trip.
2. From field studies in your community determine and list the most effective soil-conserving practices that are employed.
3. If your state has passed the Soil Erosion District law, secure a copy and make an abstract of its provisions.

4. Determine the per cent of slope on the fields of your home farm, using level and rods. The level should be set up and so adjusted that the bubble remains in the center when turned in various directions. Rod readings are taken at two points on the slope so located that one point is 100 feet from the other. The smaller rod reading subtracted from the larger one gives the slope of the land in feet per 100 feet. It is expressed as a percentage.

   Make a map of your farm indicating the slope of the land at each point according to the symbol given in the following table:

Symbol	*Per Cent of Slope*
A	0–3
B	3–7
BB	7–10
C	10–14
D	over 14

   What is the relation of the slope of the various fields to the degree of erosion found?

5. On a map of your farm, or other property which you have examined, indicate the area which in your opinion should be planted to trees in order to control erosion.
6. Write to your state college of agriculture and secure the available bulletins dealing with soil erosion control. Study these bulletins and make a report on them to the members of the class.
7. If it is possible to visit a *soil erosion control project* conducted by the Soil Conservation Service, do so. The Service will be delighted to have the class make a tour of the area. If this is not possible, then write to the Soil Conservation Service and secure a report of the work being done near you. (The office for the Southeast is located at Spartanburg, South Carolina; the office for the Southwest is located at Ft. Worth, Texas.)
8. Write a paper on the subject: *The Control of Soil Erosion in My Community.*

9. Hold a debate on some subject related to soil erosion control such as, *Resolved, that it is more difficult to control soil erosion than it is to prevent forest fires.*

10. Invite an employee of the Soil Conservation Service, the county agent, a teacher of vocational agriculture, or a farmer to come to the class and discuss the subject: *How to Control Soil Erosion.*

11. On land where there is no soil erosion, it is possible to produce 35 bushels of corn per acre; on land partially eroded, 15 bushels may be grown; on badly eroded land only 5 bushels may be produced per acre. If one-tenth of the corn land of your state is badly eroded, how much, at present prices, is the annual loss to your state? To your county? If one-third is partially eroded, how much is the annual loss?

12. For your own farm, or for the farms of your county, make up five problems like those above to determine the loss sustained from soil erosion on your farm or in your county.

CHAPTER 5

FORESTRY AND WILDLIFE

JOHN COULTER sat on the edge of a mountain stream lost in silent admiration of the scene about him. The trout had been biting and in his creel were four nice twelve-inch rainbows for his dinner. It was the end of a perfect day of sport. Overhead the sky was cobalt blue. Beneath John's feet, the stream tinkled between huge boulders, and the cool breeze that blew off the mountain and down the little valley tugged at the sleeve of his rough shirt. On every side there was a dark green wall of forest, with no sign that man had ever been there, other than the winding, overgrown trail that skirted the stream on the northern bank.

John's thoughts were suddenly interrupted by a rattle of stones in the trail. He looked up. The old ranger, whom he had seen earlier in the day, on his horse, now towered above the stone on which John sat. He was leaning on his saddle horn, looking at the boy with a twinkle in his clear, clean eyes.

"My guess," he said, "is that you've caught some four or five rainbow trout and that they will measure pretty close to twelve inches in length."

A RANGER'S GUESS

John's face went blank with astonishment. He looked at the closed lid of his creel, and again at the ranger.

"Your guess is right," he said. "Have you been following me?"

The forest ranger climbed off his horse and, leaving the animal to graze in the trail, sat down on the rock beside John.

"My deduction was simple, my boy. Thinking you to be a sportsman of the finest sort, I believed you would

Courtesy Southern Region U. S. Forest Service

A HUNTER AND HIS GUIDE RETURN TO CAMP

take no more fish than you needed, and that four or five would be enough. I also thought that if you did not have the number you wanted, you would still be fishing. And I know how large the fish in this stream are. They were 6 to 8 inches in length when planted in here four years ago. So I knew what you had in your creel."

"You used the term 'planting fish'," John said. "I thought streams were stocked with fish and that trees were planted."

The ranger looked carefully about him to see that no

combustible material was near, then applied a match to his pipe, carefully broke the match stem and dropped it into the water.

"Fish are planted just like trees," he said, after the brown tobacco was aglow. "We get the eggs and raise our trout in a hatchery. We take even more care of our

Courtesy Southern Region U. S. Forest Service

A TIMID FAWN
Three Weeks Old

tiny fish than we do of the trees, for fish have many more enemies than do trees. When the trout are large enough, we place them in rearing pools. There, under careful supervision, they grow to fingerling size. They are then brought to the mountains in cans made for this purpose and released in the streams. After the stream is stocked, as you say, it is closed to fishermen for three or four years, enough time to allow the fish to grow to legal

limit size. This stream was opened this year, as you know."

John nodded. He knew also that a number of fishermen had fished the stream before him and that many hundreds of fish had been caught. Yet this particular creek had been well stocked and the trout were plentiful. He had caught his dinner in a few hours of easy fishing. The old ranger seemed to have read his thoughts.

"Usually fishing is good in a stream for several years before it has to be closed and restocked, depending, of course, on the amount of fishing, the amount of fish food available, and several other things. Then we treat it just as we would treat a stand of forest trees. Either part of the stream is closed to fishermen and fish planted in the remainder of the pools and rapids, or the entire stream is closed and restocked. Always some streams in the national forest are open and nearly all of them are filled with big fish, too smart to fall for the angler's fly or worm."

"Do you use rainbow trout altogether in restocking?" John asked.

The ranger shook his head slowly.

"You are too good a fisherman to ask that. You know that we stock the cold water at the heads of the streams with speckled or brook trout, and in that further down the stream where the water is warmer from running over warm rocks, we place our rainbow. We have also planted many bass where the water flows through the valleys, though as a rule the fishermen who come up here are after trout and the bass themselves lead long, healthy lives."

"Is this fish planting in connection with your game refuge?" John wanted to know.

The forest ranger scratched a moment at the frizzled edges of his gray hair.

Courtesy Southern Region U. S. Forest Service

A Wild Boar in Cherokee National Forest

A GAME REFUGE

"In a way, yes. It is a part of our game and fish program, which is one of the phases of our national forest work."

John knew that a game refuge had been established beyond the mountain. Each year many deer from other

Courtesy Southern Region U. S. Forest Service

A BEAVER DAM

Beavers are increasing in the South. They are industrious little animals and serve mankind in many interesting and useful ways

national forests where they had grown too numerous, had been brought into this national forest and placed on the refuge. Over a number of years they had scattered into many counties of the state, where they were protected, and recently a large buck had been seen almost fifty miles from the refuge. Deer hunting throughout the counties surrounding the forest would be open in a few years.

Turkeys, too, were safe from the guns of hunters on the original wildlife area. Forest service officials knew that if game was protected on the ten-thousand-acre refuge, sportsmen could always be assured of good hunting in and around the forest.

Courtesy Southern Region U. S. Forest Service

A Black Bear in the Cherokee National Forest

"Are you making an attempt to bring game back to its former plentiful state?" John asked.

The old ranger shook his head, and his eyes looked beyond the wall of forest, beyond the mountain crest. His vision seemed to reach back into other years.

Game Once Plentiful

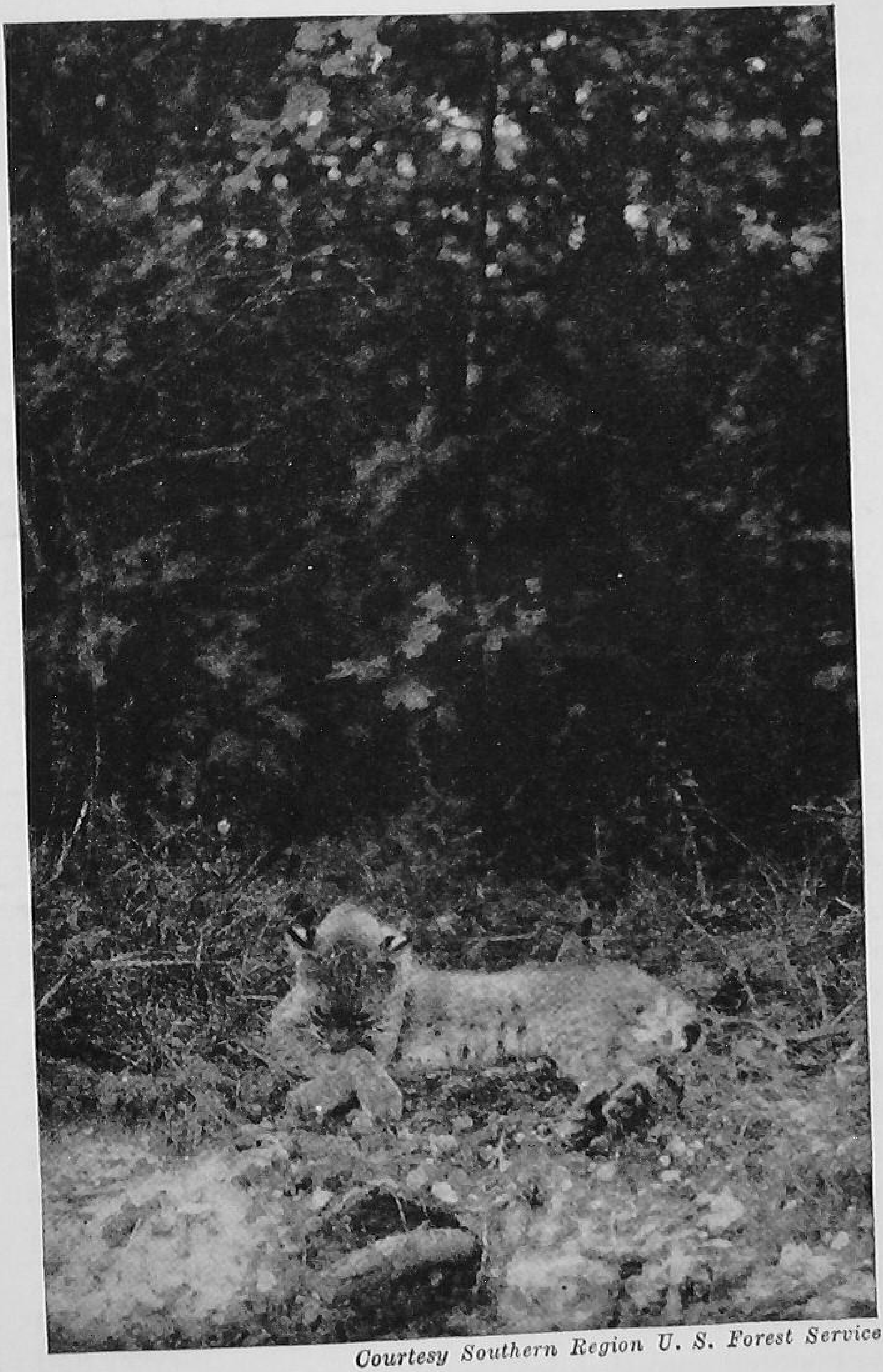
"There was a time," he said, slowly, "when this land of ours teemed with game. Wood bison roamed the vast Southern forests. Bear and deer were plentiful and

the flocks of wild turkeys were numbered in the hundreds. Flocks of ducks and geese came to the South in such untold thousands that it is almost beyond the scope of our comprehension today.

"The story of the passenger pigeon is one of the most tragic stories told of the North American continent. Even within my lifetime this bird has completely disappeared. The old timers living around the valleys say that they remember when thousands upon thousands of those birds stopped in migration and roosted on the mountain tops. The natives would go to the mountain tops with burlap sacks and mules and bring home bushels of those game birds. What they could not eat, they would feed to the pigs. Companies were established for the sole purpose of killing and selling pigeon meat. One company's records show that in the year 1861, 11,880,000 wild passenger pigeons were killed and shipped in one season!

"Other kinds of game on the North American continent shared this period of destruction. Men were not farsighted enough to realize that such slaughter could not go on forever. Famous Buffalo Bill Cody told of killing four or five hundred wild turkeys at one of his forest camps. The slaughter of the buffaloes on the plains of the West is a disgraceful chapter in the history of our nation. So-called sportsmen would ride along on the train and shoot the animals as they grazed on the prairie, leaving them for the coyotes and vultures. At one time a bounty of 25¢ per bird was put on the grouse in Massachusetts because the birds were doing much damage to the fruit trees.

"A few years ago we began to awaken to the fact that our game was almost gone. The passenger pigeon had disappeared entirely, and not a single bird of the species was left in existence. Shooting game for the market



Courtesy Southern Region U. S. Forest Service

A WILDCAT

had also helped to reduce many other species. Clearing of large tracts of land depleted the number of deer and wild turkeys. The draining of the Northwest marshlands and lakes for agricultural purposes was disastrous to the ducks. In many parts of the South, farmers and fishermen carry shotguns all summer and pot what they can, in breeding season and out. All of this has brought on the scarcity of game that we have today."

John Coulter was very much impressed. He had never heard any one talk more feelingly on any subject.

Game Laws

"But what about our game laws?" he asked.

"It is true," the ranger said, "that our first game law was passed at Plymouth Colony in 1623, but that was merely to designate game as public property except on the land of an individual. It was long years later before laws were established for the actual protection of game birds and animals, but only in a few of our Southern states has the enforcement of those regulations been drastic enough.

"Game thrives under protection. The birds and animals soon learn which areas are unsafe and which are not. One of my rangers hunted pheasants in a Northern state last fall. On the day the season opened, all the pheasants in the country came into the city limits of small towns, and stayed there until the day the season was over. In some manner they had found out that shooting a gun within the city limits was illegal. Have you ever noticed that the first week before hunting season opens, deer are plentiful and on the opening day, not one can be found? It's true. I've seen it happen a number of times.

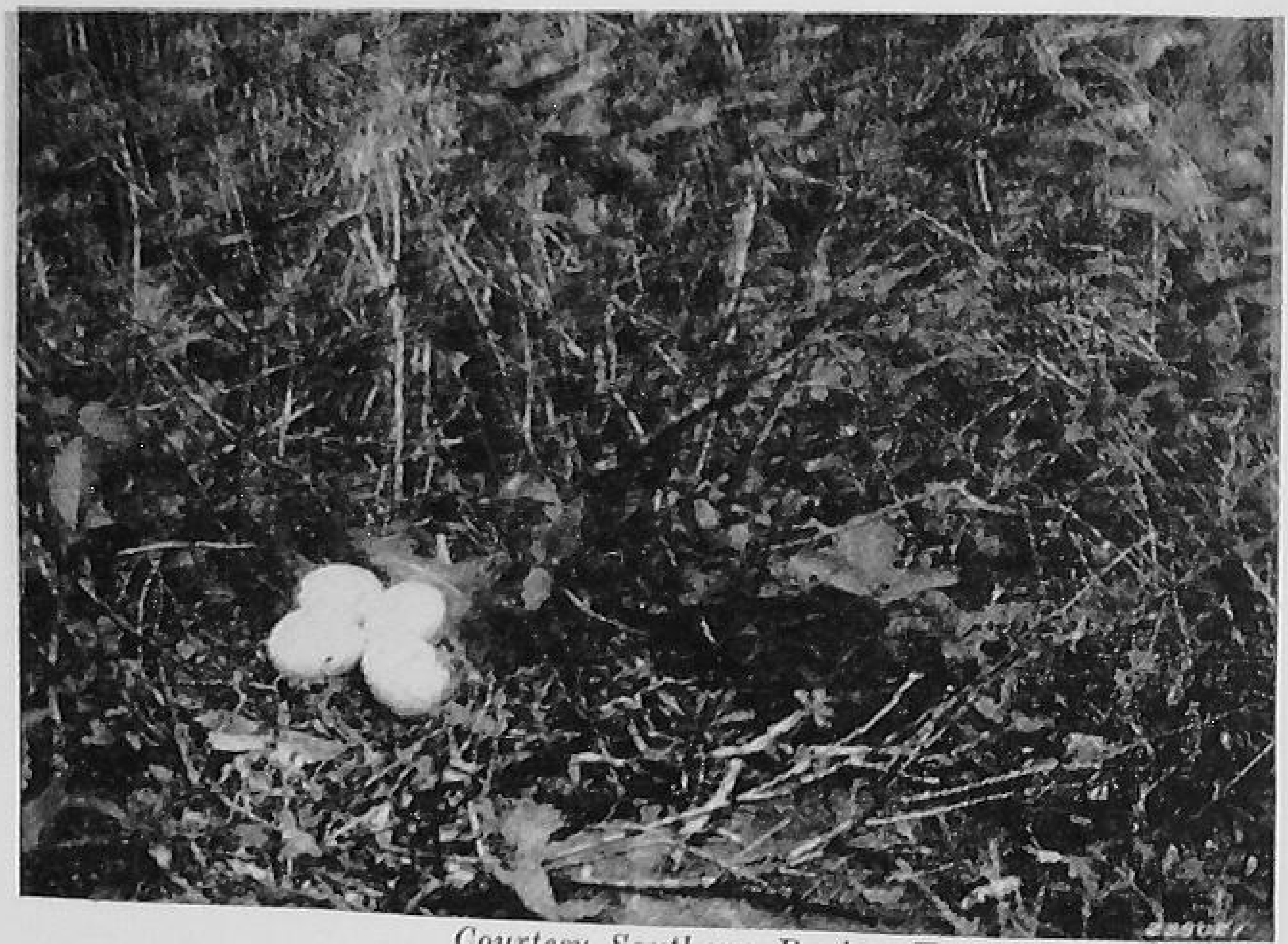
"I understand that in Georgia now they have a program to set aside a thousand acres in each county as a

Courtesy Southern Region U. S. Forest Service

A Wild Turkey

natural resource reservation. There the game will be protected and allowed to overflow into the county and adjoining counties, when the reservation becomes too heavily stocked. I think that it is a great idea and will eventually build up the game to a maximum in that state."

"If the sportsmen would cooperate in enforcing the



Courtesy Southern Region U. S. Forest Service

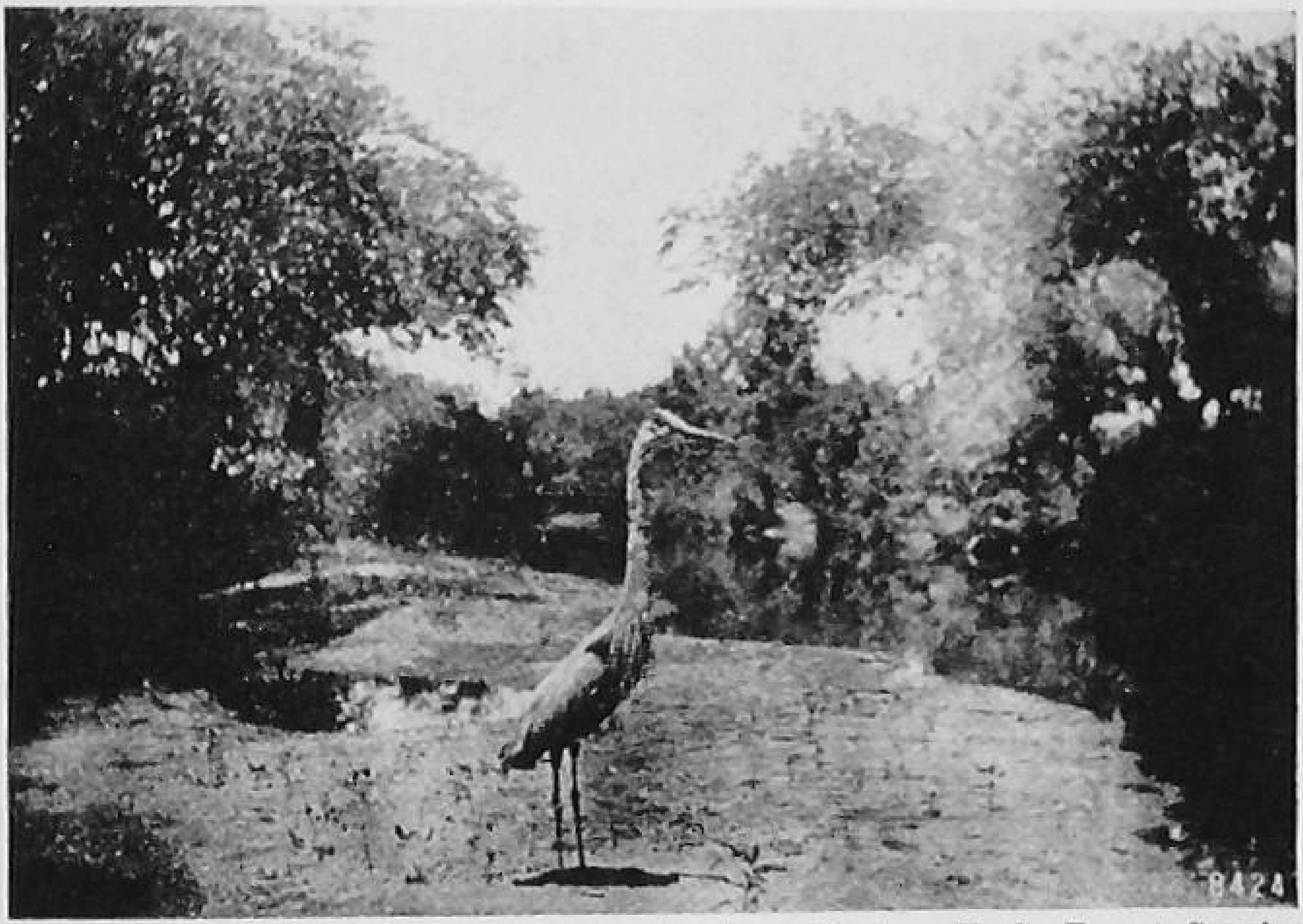
A Wild Turkey Nest
Pisgah National Forest

game laws, then," said John, "that would mean an increase of the game."

The forest ranger grinned.

"If all sportsmen were good sportsmen, our troubles would be over in so far as an adequate game supply was concerned. The number of sportsmen in this country have increased from two million in 1860 to more than seven million licensed sportsmen today and the number is still increasing at the rate of 200,000 annually. But

I am inclined to believe that either ignorance or lack of interest is the reason for much of our deficiency of game. Sometimes it is abysmal ignorance. When I say that, I think of the man in New York a few years ago who decided to go hunting. He had never hunted, but it sounded like a good idea. Consequently, he went down to the sporting goods store and upon recommenda-



Courtesy Southern Region U. S. Forest Service

THE GREAT BLUE HERON

tion of the clerk bought a high powered rifle. He took the train up the Hudson River to Bear Mountain State Park, walked from the station over to the elk pen, pushed his rifle through the wire and shot the largest tame elk in the park. He was honestly surprised when the park rangers arrested him for possessing a rifle on a game refuge, for killing elk out of season in a state where they were protected altogether from hunters, for endangering the lives of thousands of picnickers and visitors, and for disturbing the peace. He wanted to

carry the case into court to prove that he had been within his rights."

John laughed. He remembered hearing his father tell about the same incident.

"Of course," the ranger continued thoughtfully, "wildlife has other values besides furnishing recreation for hunters. There are a great many birds, for example, not listed among game birds, which our laws protect as song birds. Such birds as the robin, cardinal, wren, and our warblers and sparrows fall in this list. As little as we think about it, those birds serve their own purpose. Without them, man would soon perish from the face of the earth."

John laughed.

"You'll be telling me next that there's not any Santa Claus."

"I'm serious," the ranger said. He fumbled in his pocket. "Here is a clipping I cut out of the paper a few days ago. Read it."

John took the clipping. It read:

How Birds Help Mankind

"To show the astonishing capacity of birds' stomachs and to reveal the extent to which man is indebted to birds for the destruction of noxious insects, the following facts are given as learned by stomach examinations made by assistants of the Biological Survey:

"A tree swallow's stomach was found to contain 40 entire chinch bugs and fragments of many others, besides ten other species of insects. A bank swallow in Texas devoured 68 cotton boll weevils, one of the worst insect pests that ever invaded the United States; and 35 cliff swallows had taken an average of 18 boll weevils each. Two stomachs of pine siskins from Hayward, California, contained 1,900 black olive scales and 300

plant lice. A killdeer's stomach, taken in November in Texas contained more than 300 mosquito larvae.

"A flicker's stomach held 28 white grubs. A nighthawk's stomach collected in Kentucky contained 34 May beetles, the adult form of white grubs. Another nighthawk, from New York, had eaten 24 clover-leaf weevils and 375 ants. Still another nighthawk had eaten 340

Courtesy Southern Region U. S. Forest Service

A Fish Hatchery

Showing pools and spillway

grasshoppers, 52 bugs, 3 beetles, 2 wasps and a spider. A boat-tailed grackle from Texas had eaten at one meal about 100 cotton bollworms, besides a few other insects. The crop of a ringneck pheasant from Washington contained 8,000 seeds of chickweed and a dandelion head. More than 72,000 seeds have been found in a single duck stomach taken in Louisiana in February."

John whistled.

"I didn't know anything like that!"

"That's not all," said the ranger. "Birds of the United States each day eat many tons of insects. Many tons, mind you, of those destructive, fast-multiplying pests which would soon devour every green leaf of the forest, every blade of grass and every bit of vegetation on earth, if it were not for birds, which act as checking agents against these destructive hordes. And I repeat, if it were not for birds, man would soon perish from the face of the earth.

"Do you, for instance, ever notice how completely the various species of birds cover a tree in the search for insects? I'll bet you haven't. Nature has so arranged her kingdom that not one possibility is overlooked. On the ground you find towhees and robins, scratching in the leaves and earth for worms. On the trunk of the tree you will see a woodpecker, pecking and digging in the crevice of the bark for insects hidden there. He works up the tree. Higher above him, moving down the tree trunk from top to bottom, is the nuthatch, that always hangs head downward and works the under surface of limbs, finding those insects that the woodpecker missed. On the trunk you will also find the black and white warbler, brown creeper, and other species seeking every crack and cranny and missing few of the insects.

"Species like some of the warblers and chickadees, kinglets and many others thoroughly search the twigs and leaves of the trees for any insects preying on that portion of the plant. Flying around the tree are the swallows, flycatchers, nighthawks and other species of birds which take insects on the wing.

"Thus, you see, the entire tree is searched from top to bottom by many birds with certain characteristics which adapt them particularly for that purpose.

"Nature is wise in her ways. We look on hawks and owls as birds of destruction, that kill our song birds and destroy our game. We make an attempt to eliminate them, for we think we can improve on Nature. Few people ever realize that hawks and owls and other birds of prey were placed on this earth for a purpose. Did you ever stop to think that, although they kill many of

Courtesy Southern Region U. S. Forest Service

FEEDING FISH AT THE HATCHERY

our song birds and much of our game, the birds they usually catch are those which have been wounded, or which are weaker than the other birds? That is nature's provision to make each species stronger and keener. By killing the diseased and weaker birds and animals, only the strong will survive, and a species becomes more healthy and more perfect as generations pass. The survival of the fittest is one of Nature's first laws.

"Nature has made another provision. Where birds breed in cold climates or where they are destroyed rapidly by their natural enemies, they lay large numbers of eggs and raise a large brood. Hawks and owls themselves and turkey vultures seldom lay more than two eggs for their brood. The quail lays a dozen and a half or two dozen and the wild turkey lays almost as many. The birds that go far north and place their nests in the shadow of snow-covered mountains, or on the cold tundra, have large numbers of eggs in their nests."

"Nature certainly is wise," agreed John.

Farmers and Wildlife

"But to go back to our game birds and animals," said the ranger, "there is one man living on the edge of the national forest who is doing something about his game. He has a nice little income from his game alone. For the past few years his farm has become nationally known as a hunter's paradise and sportsmen come from all over the country to hunt each year. I've told you what we do to protect game on the national forest. Now I'd like for you to see what a private individual can do toward propagation of game on his own land, and how he has made it pay. Suppose you meet me at Style's Cross Roads in the morning and let's take a look at Roy Terrel's place."

John Coulter was already at the cross roads the next morning when the forest ranger arrived. They rode up a long driveway to a beautiful old home that sat in an ancient grove of oaks. They found Roy Terrel in the back yard, throwing sticks for two pointer puppies to retrieve.

"Loafing, as usual," laughed the ranger.

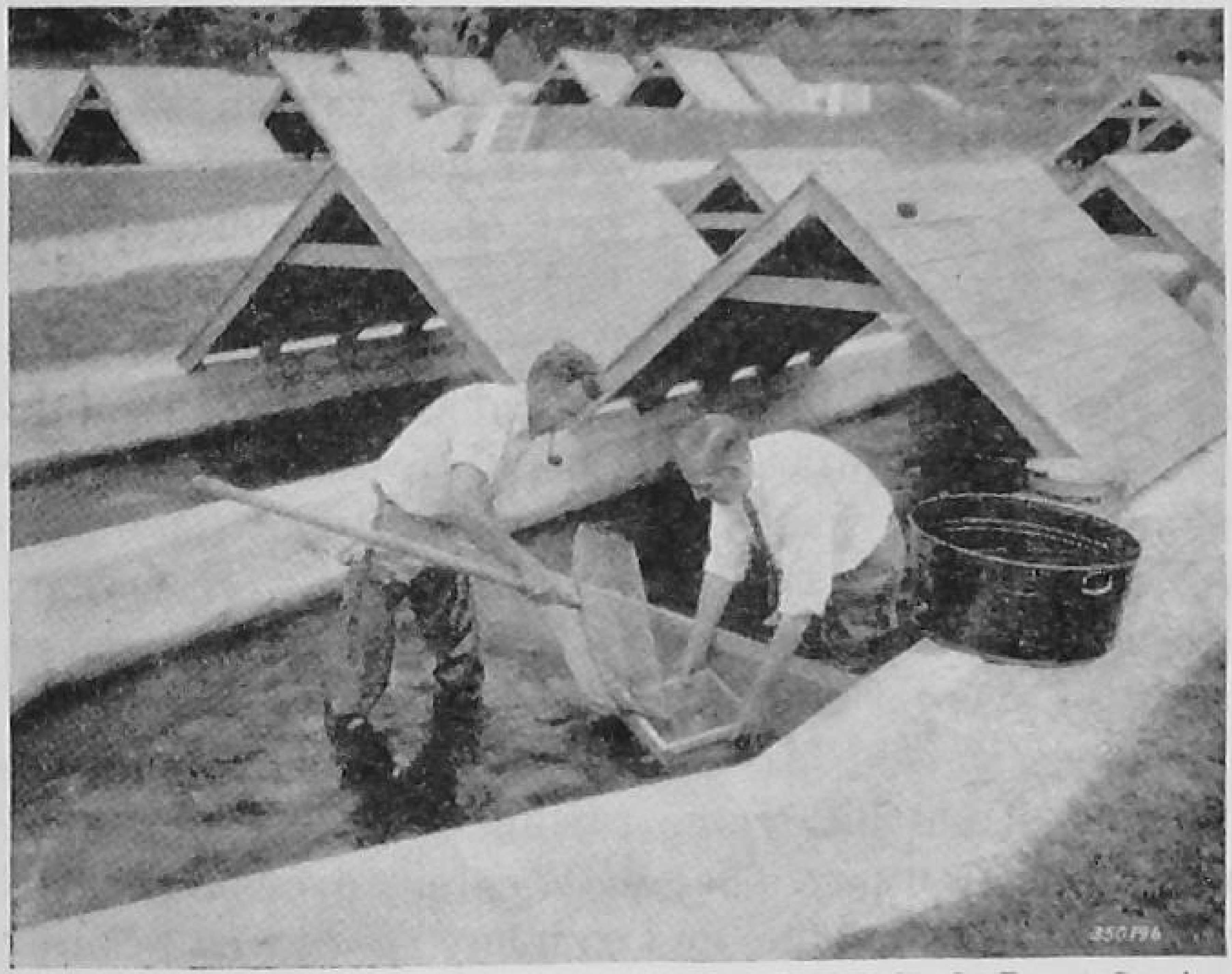
Roy Terrel shook hands warmly.

"You're wrong, as usual, Bill," he said to the ranger.

"These bird puppies are getting their first lessons in bringing in birds that have been shot down. They belong to an old customer of mine. They're valuable dogs and he's giving me a tidy little sum for training them."

The ranger introduced John and explained the purpose of their visit.

"I'm delighted to be able to show you around," said



Courtesy Southern Region U. S. Forest Service

SORTING FISH FOR STOCKING STREAMS

Roy Terrel. "First I'd like for you to see a management map I've made of my place, so you will be able to better understand what I'm trying to do."

In his office the farmer had framed and hung a map of his property. It was laid off neatly, a certain area devoted to crops, more of the land devoted to pasture and the remainder, designated as ungrazed land, was devoted to game management and hunting.

"There are something over a thousand acres in this place," he explained. "The experts say that a thousand acres or more are needed for good management."

"How did you happen," asked John, "to add game birds to your list of farm crops?"

"I've always had pretty good hunting here," said the farmer, "because I have always made every effort to protect it. But undeveloped it proved to be a liability rather than a source of income. The hunters who came across my property tramped down the grain in my fields, wrecked my fences and were a general nuisance. I even had one cow killed and once an unscrupulous hunter shot two of my tame turkeys. Unless I patrolled the area day and night, there was little I could do to keep the hunters out, so I decided to make it available and charge a fee for hunting privileges. It was the wisest move I ever made. I found that sportsmen were willing to pay the price of good hunting. This year I will make twice as much from hunting as I will from my crops. Come on and I'll show you around my place."

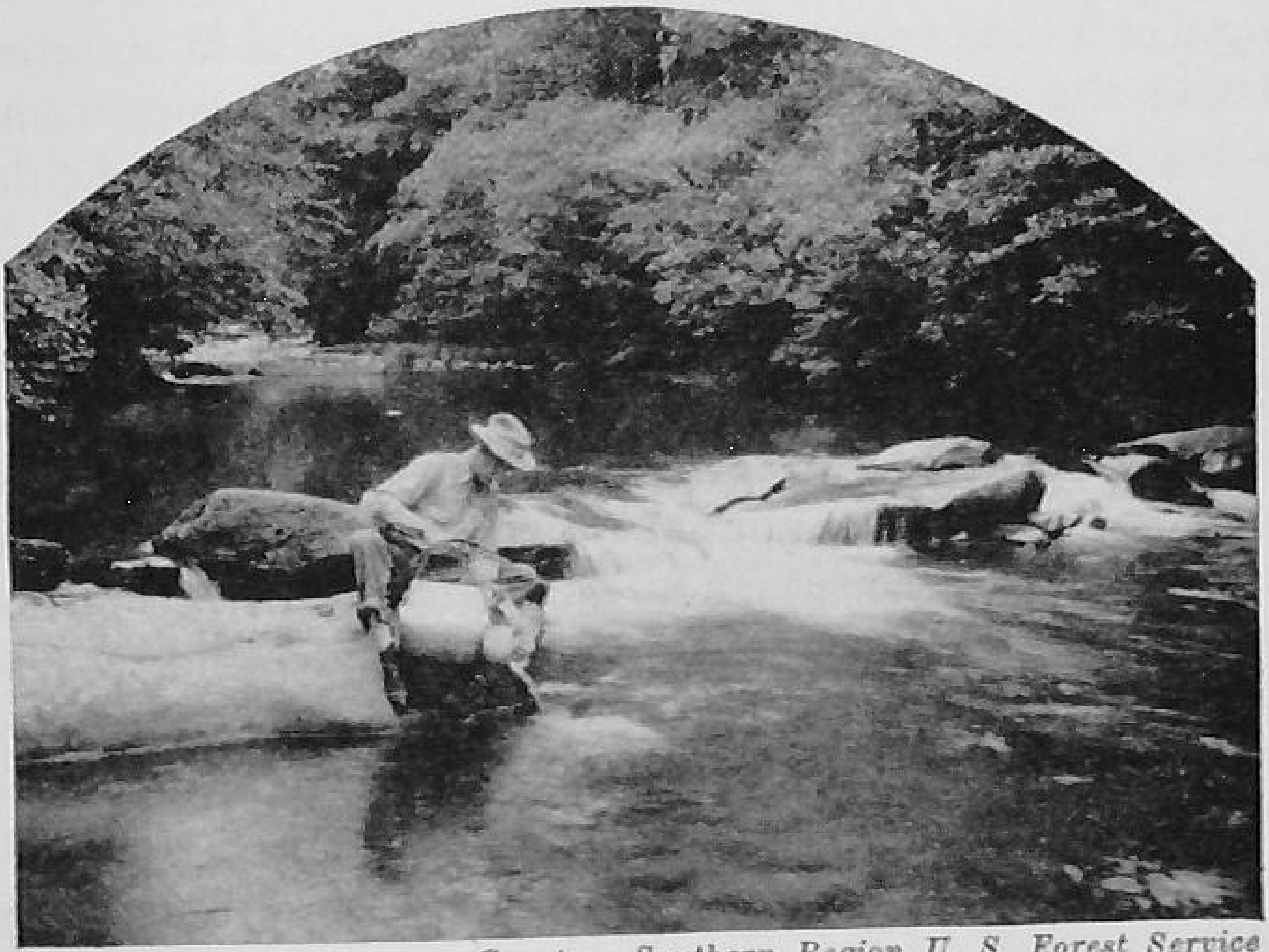
As they walked Mr. Terrel made other explanations.

"Since I got into game raising, I have found many ways to make it pay. See those cabins over there? It's a long way to the hotel and so many sportsmen began to come here for a week's shooting that I had to make some provision for lodging. We serve meals in the huge dining room of the old homestead.

"I charge for shooting rights on this place by the day and by the week. But I am careful never to overshoot it. When a certain number of birds have been killed and the stock is down pretty low, the season closes on the Terrel preserve. Some other farmers who allow shooting the same way I do, charge by the bird or by the season.

"There are many other ways of making this place

pay. In season, we furnish guide service. That provides work for some of the local boys and increases our own income. We breed dogs, and train dogs for our patrons. We also furnish good dogs when a sportsman comes from the North or South and does not want to go to the trouble of bringing his own dogs with him."



Courtesy Southern Region U. S. Forest Service

STOCKING A MOUNTAIN STREAM WITH TROUT

After being stocked with fish from a hatchery, the stream is closed for fishing for a time to allow the fish to grow to desirable size

"You've thought of almost everything," commented John Coulter.

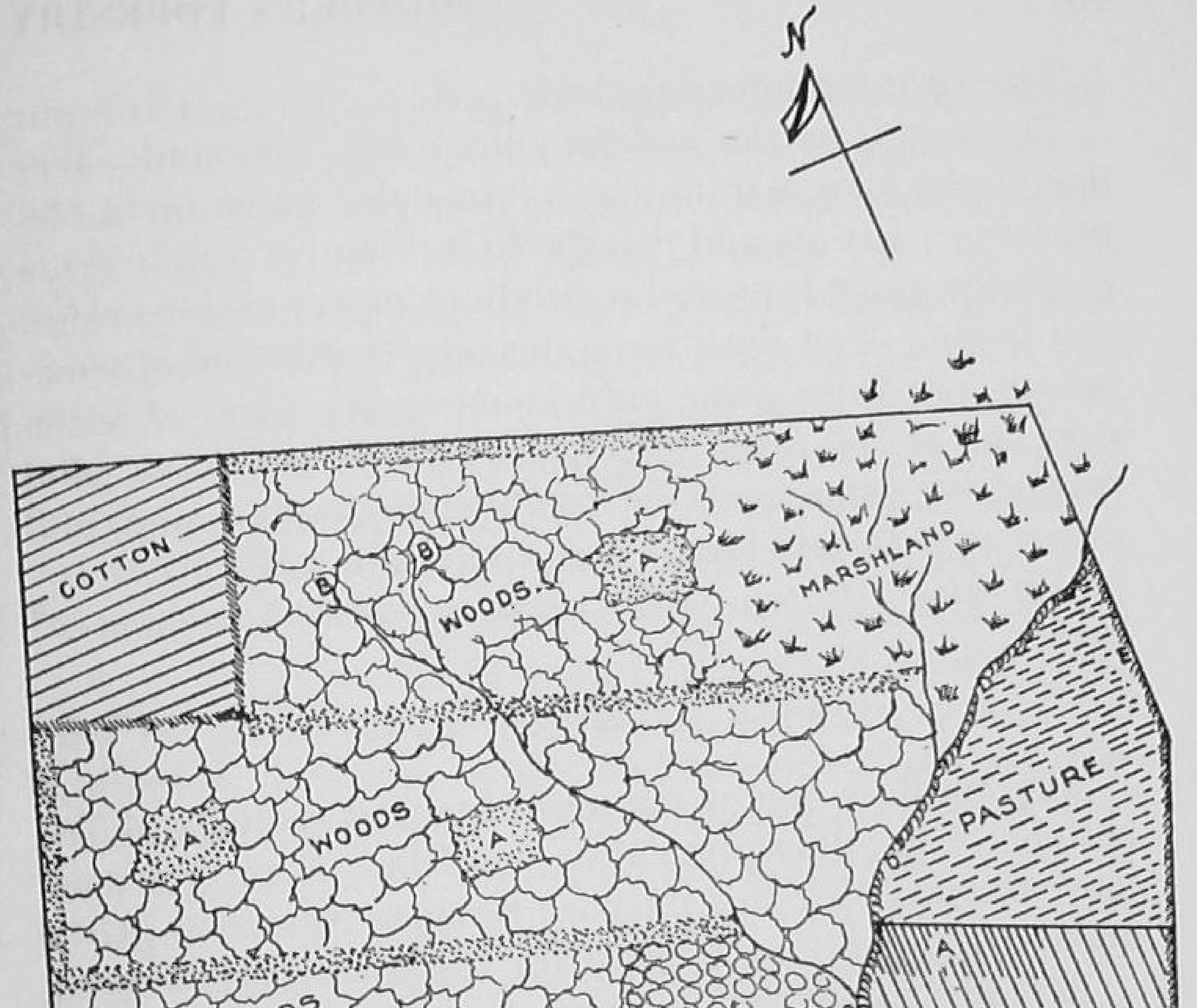
"I've just started telling you of the things we do," laughed Farmer Terrel. "There are more angles to this game business than I ever thought when I started it. The sale of fur pelts from predatory animals on this place brings a sizeable income. We raise rabbits, turkeys, pheasants, ducks, and other tame fowl in cap-

tivity. We started this to assure enough food for our customers, and now we find that they buy and carry home a great deal more than they eat from our table. We also have a small game farm. Game birds bring an exceptionally high price. They are not easy to raise, and we had to begin on a small scale, get all the information we could from the government in the form of bulletins, and then gradually expand. There are many good books and bulletins on the subject of raising game, and a beginner should study those thoroughly."

"What are the most important game requirements?" John asked.

"First of all," said the farmer, "the character of land and section determines the game species. I know a farmer in lower Louisiana who shows his guests some of the finest duck hunting in North America. He converted his swamps and natural lakes, which comprised his tax-eating property, from a liability into an asset. Some of the finest grouse shooting I have ever seen was in the forest of a Michigan farm. That forest proved more valuable to the farmer as a shooting preserve than it did as a source of winter wood. I have adapted this farm to quail by leaving my marshland and woods ungrazed, by leaving certain small portions of my crops standing to provide food for the birds, by protecting my farm from fire with fire breaks and planting those breaks to wheat for the birds, by scattering small patches of wheat throughout the rougher portion of my farm, by growing various kinds of seeds and berries in my hedgerows, and by keeping out stray cats and dogs that eat young quail and quail eggs.

"With such a program, winter feeding is not needed in the South, as it is in some of the northern states. The birds have an abundant food supply throughout the winter months."



A—Grain Left Standing
B—Note Fire Break Through Woods
D—Copse Along Creek
E—Hedge Row

TERREL'S GAME MANAGEMENT FARM

The forest ranger laughed.

"I can tell by the look in John's eye," he said, "that this young man is thinking in terms of a game farm and preserve. Let me add that the first thing for you to do is to get the game laws and regulations of your state before you begin. You must have special permits and licenses before you raise game on a commercial scale. I think it is one of the finest jobs a young man can have—the raising of game and the establishment of a shooting preserve. It provides clean sport and recreation for others and for the young man himself a successful career."

Wildlife and the South

The South is one of the more favored sections of the nation for the development of wildlife. Forests are almost essential for this purpose because trees and brush make a relatively safe home for birds and animals.

Already in the South there are a number of game preserves established on private estates. On these great estates, men are employed to feed and to propagate game. On many such estates quail are hatched and released when old enough to take care of themselves. Crops are planted for the quail and turkeys just as for the mules and other livestock on the average farm.

Some of the private preserves specialize in the raising of deer. There are many sections of the South where there are deer in large numbers.

Big game is multiplying rapidly in the national forests. Each year there is, for example, an open season on deer in the Pisgah National Forest. When first opened any hunter who wished to go deer hunting filed his name with the officials of the game refuge. If his name were drawn, he was required to pay a fee of five dollars, and was allowed three days in which to hunt. During that

period he was allowed to kill one buck. If he killed the deer the first day, then he was required to stop hunting.

There are wild hogs in some parts of the Southern mountains. Each year a hunt for these animals is organized. Since this sport is so unusual, much publicity is given to it by the newspapers in all parts of the country. These hogs will, doubtless, soon be extinct.

Some states in the nation derive large incomes from big game hunting. Among these states are Pennsylvania, Maine, and Colorado. Hunters come to the Maine woods, for example, from all parts of North America. They are charged fifteen dollars for a license, and are required to employ a guide before they are allowed to go into the woods. The guides are paid four or five dollars a day. Thus it becomes apparent that each hunter spends many dollars for the privilege of trying to shoot a deer.

Thousands of dollars are spent by sportsmen in the South each year. Perhaps the largest sum is spent for fishing. In Florida, for example, hundreds of boats are available to fishermen at twenty-five dollars a day. Many sailfish cost the men who catch them as much as five dollars a pound—but they think it well worth the money.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What kind of fish did John Coulter have in his creel? Why are these fish prized so highly by sportsmen? Where are they to be found? How does one fish for this species?
2. What was the forest ranger's guess about the fish in John's creel? Upon what did he base his guess?
3. What are some of the characteristics of a good sportsman?

4. If a stream is *closed* for fishing, what are some of the reasons why the regulation should be observed? Why should no one fish during a *closed* season? What is meant by a closed stream? A closed season?
5. Why should the "bag limit" be observed in hunting and fishing? Why should small fish be thrown back into the stream? What is the limit on the size of trout that may be caught and kept?
6. Do you have a fishing license in your state? How much is it? Where may licenses be obtained? What is done with the money?
7. Why should all of us be interested in increasing wildlife, including fish?
8. What are some of the ways in which wildlife may be increased? What is your state doing to help in this effort? What is the Federal Government doing?
9. What is meant by the term *planting fish?* Where do the fish come from?
10. What is a fish hatchery? Do you have hatcheries in your state? Where are they located? Have you ever visited a fish hatchery? If so, describe it. What kinds of fish are propagated in your state?
11. What is a *fish pond?* How constructed? What kinds of fish are found in the fish ponds of your state? What kinds of fish are in the streams of your state?
12. Is your state noted for fishing? Do visitors come to your state to fish? What kinds of fish do they catch? Tell how and where this fishing is done.
13. What is a *game refuge?*
14. Do you have deer hunting in your state? Turkey hunting?
15. Tell the story of the destruction of the passenger pigeon.
16. What are the game laws of your state? What department of the state government is interested in the protection of game? Do you have game wardens in your state? What do these game wardens do? How many game wardens do you have?

17. How do birds benefit mankind? Why should they be protected?
18. What are some of the more common birds found in your community? Do boys shoot these birds? Should this be done?
19. Do you have quail in your state? When is the "open season" on these birds? Do you have a bag limit? If so, what is it?
20. Did you ever see a bird hunting for insects? Tell something of the different characteristics of birds with respect to the way they look for food.
21. How can farmers make game a crop? How many acres are required as a minimum?
22. What are some of the ways that game may be protected and multiplied on farms?
23. What was the plan of Roy Terrel as described in the text?
24. How many ways had Roy Terrel found to make game management and hunting a source of income?
25. How is wildlife related to forestry? To recreation?

Selected References

Farmers' Bulletins (U. S. Department of Agriculture)
630—Some Common Birds Useful to the Farmer
755—Common Birds of the Southeast
1456—Homes for Birds
1644—Local Bird Refuges
1682—Useful Birds on the Farm
1719—Improving the Farm Environment for Wildlife
1766—Game Laws for the Season
1759—Game Management on the Farm

Circulars (U. S. Department of Agriculture)
339—A Program of Waterfowl Restoration
348—Quail Food Plant of the Southeast

Bulletins (More Game Birds in America, 500 Fifth Ave., New York) (These bulletins are free upon request)
More Upland Game Birds

Game Birds—How to Make Them Pay On Your Farm
Quail Breeding Manual
More Game Birds By Controlling Their Natural Enemies
Water Areas—How To Create and Maintain Them
Waterfowl Food Plants

Note: State departments of conservation, state departments of game and fish, state planning boards, and other state agencies have published many interesting, attractive, and valuable publications dealing with wildlife and with hunting and fishing. Write for these bulletins.

Suggested Activities

1. Write to your state department of fish and game at your state capital and secure copies of all available publications, if they are not already in your school library, and become familiar with the work of this division of your Government. Make a report on the subject: *Wildlife in My State.*
2. Secure the bulletin from the U. S. Department of Agriculture dealing with bird houses and make one or more homes for birds.
3. Study the habits of one bird species and make a report to the members of the class dealing with all the facts you are able to discover.
4. Do you have any big game in your state? If so, tell the story of hunting big game, either as you have experienced it yourself, or as the account is given you by some hunter.
5. Outline a plan for game management on the farm as it may be practical for the farmer to increase the game on his place, either for hunting himself, or for commercial purposes. (The U. S. Department of Agriculture has published a bulletin on this subject.)
6. Tabulate the game laws of your state. This information may be secured from your own state department of fish and game, or is published annually by the U. S. Department of Agriculture, or it may be obtained—at some season of the

year—from the hunting and fishing magazines found on the newsstands.

7. From a newsstand secure a magazine dealing with hunting or fishing. Read the magazine carefully and make a report on it as you would make a book review.
8. Visit a fish hatchery, if possible, and write a report of your observations. If this is not possible, then secure information from your state department of fish and game, or from the U. S. Forest Service, in regard to the manner in which fish hatcheries are operated, the kinds of fish they propagate, and the time, methods, and places of planting.

Chapter 6

FORESTRY AND RECREATION

MORE than seventy years ago, a man stood on the edge of a vast timber operation in California. A lumber company was cutting down one of the redwood forests. One by one, the observer saw the gigantic redwood trees bend their shaggy heads, sway, and crash to earth. Many of those forest patriarchs were thousands of years old. Some had been born while Egypt was a dominant power, and Khufu was building the great pyramid. Some had sprouted into seedlings while Moses was leading the Children of Israel out of bondage. All had been huge trees before the first ax was made. The birth of that forest antedated the birth of Christianity. Many of the trees were old when Genghis Khan conquered an empire which extended over ninety degrees of the earth's longitudinal surface and was eight thousand miles from border to border. Now they were falling, one by one, before the ax of the white man, to be converted into lumber for houses and furniture and office buildings.

The man who stood and watched those monarchs fall was not thinking of himself, or of the lumber companies. He was thinking of other generations, of the boys and girls and men and women who were yet to take his place and the place of other men and women in the world. He was thinking that posterity would never see the redwood forests, which would soon be gone, leaving only colossal stumps where they had stood.

Courtesy U. S. Forest Service

THE CAMPFIRE CIRCLE

Girl Scouts enjoying a vacation in the George Washington National Forest in Virginia

On that hillside, with the smell of timber dust in the air, with the roar of falling giants against the mountain, an idea blossomed in the mind of the observer. *Some of those huge trees, older than any other living thing, must be saved for other people to see and enjoy!*

That incident in the life of Galen W. Clark was possibly the beginning of the park idea.

In 1865, California set aside two areas, in order to save them from the greed of man. One was the Mariposa Grove of big trees and the other was Yosemite Falls. In 1890, both of those areas were deeded to the United States of America as national monuments, "to conserve the scenery and the natural and historic objects and the wildlife therein, and to provide for the

enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The thought of *saving* the trees and other scenic areas instead of exploiting them was something entirely new

Courtesy Southern Region U. S. Forest Service

A Sail Boat at a Boy Scout Camp in Florida

and a great many years passed before the idea was fully accepted by the American people.

National Parks

When the Antiquities Act was passed by Congress in 1906 to allow the President of the United States to set aside as national monuments such lands as had outstanding scenic grandeur and historic interest, eleven such areas had already been established. The act creating the National Park Service was passed by Congress in

1916 and today over 90 national parks and monuments are in existence.

A few years ago in the South, the average citizen was essentially either a worker of the forest or of the soil.

A NATURE TRAIL IN SOUTH CAROLINA

Doesn't it look inviting? This is one of the Nature trails to be found in Poinsett State Park, Sumter County, South Carolina

All of his daylight hours were needed to make bread and meat for his family and to provide food and shelter. His recreation came once each year, when he made a trip to the nearest large town to dispose of the surplus products grown in his fields.

Today, the picture has changed. Vacations are popular and week-end trips are quite common. Persons in moderate circumstances often drive fifty or one hundred miles for a day's picnic or outing.

Recreational Centers

There are a number of types of recreational areas which these average families may select. They might go to some commercial recreational spot, owned and

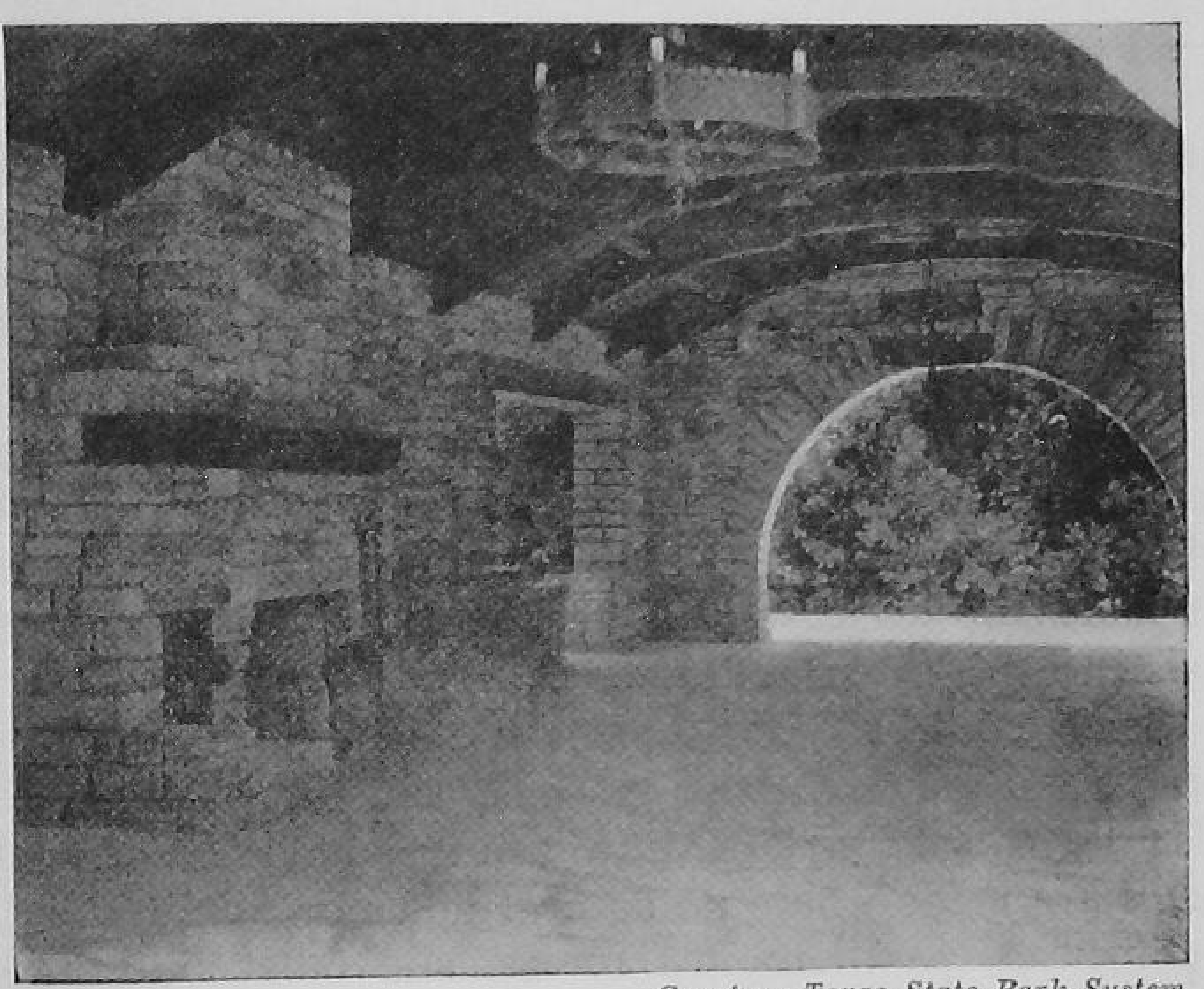
Courtesy Southern Region U. S. Forest Service

Juniper Springs
Ocala National Forest

operated by an individual or by some private company. They might go to a national park, if one is close by, to a state park, to a national forest Recreational area, or just to some far spot in the wilderness. Usually, though, they go to some recognized public recreational area.

To take care of the vast number of vacationists and week-end visitors and the increasing number of persons who travel during the week-end, a number of important developments have taken place during the past few years.

One of those developments is the growth of state parks. When the public began to know and appreciate national parks a few years ago, Stephen Mather, who was then director of the National Park Service, received



Courtesy Texas State Park System

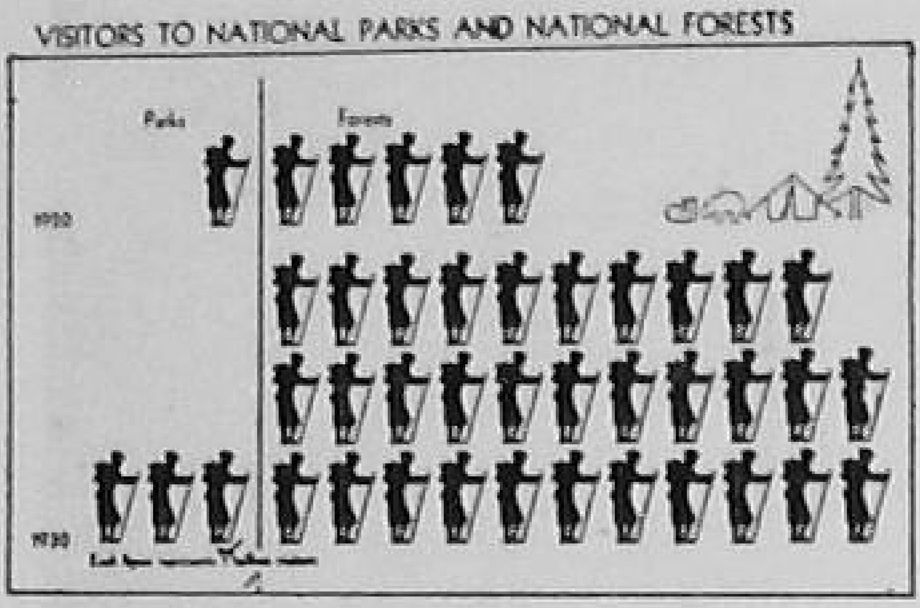
A TEXAS STATE PARK

Mother Neff State Park's refectory building emphasizes rustic construction. All interior furnishings were handmade by CCC enrollees

more applications for the establishment of national park areas than he could even investigate. He found though that few of those areas surveyed were of national importance or significance. As a result, he called a meeting of several prominent men who were interested in recreation and with them formulated a state park plan. These men recognized that there were certain areas in each state which were not of national significance, but

which should be preserved. Thus the state park idea was born.

State parks are usually created for one of three reasons. One is for the preservation of scenic beauty where certain commercial interests threaten to destroy it. Another is for the preservation of historic sites, where a great man lived, or where some event, vital to the history of the state, took place. The last, and equally important reason for the establishment of state parks, is to provide recreational facilities close at hand for those seeking respite from the strenuous existence which characterizes modern life.



Sometimes the establishment of a state park area embraces only one of those reasons, sometimes all three. Usually recreational facilities are provided. Artificial lakes are made where no natural lakes occur. Cabins, bathhouses, pavilions, tea rooms, and other buildings are erected for the convenience of the public. Picnic areas, with outdoor fire places, tables and benches and picnic shelters, are established for those who come to spend the day. Trails for hiking and bridle paths for riding are made. Certain areas within the boundaries of the state parks are left in wilderness for those who wish to come and see the forests and wildlife just as they were in their primitive state.

As in national parks, no commercial industries are permitted to operate in state parks. No hunting is allowed and fishing is permitted only at certain specified seasons of the year and in certain streams.

Throughout the South, within the national forests,

recreational units are being established. Usually the development is not quite so intensive in the national forests as it is around the edges of national parks, or within state parks. Most of the provisions in Uncle Sam's

Courtesy Southern Region U. S. Forest Service

AN OBSERVATION POINT

Where the view is especially good, observation platforms are built. Thousands of visitors each year enjoy the scenic grandeur from these selected sites

forests are for those visitors who come to spend the day. Lakes for boating, swimming, and fishing have been built. Picnic areas, with shelters, sanitary facilities, and cooking units, have been provided. Each year those selected beauty spots and the facilities in them are used by thousands of visitors who come to enjoy the national forests.

Other types of areas have come into existence during

Courtesy Southern Region U. S. Forest Service

A Family Picnic

Young and old enjoy such outings. State and Federal Services are anxious for all the citizens of the nation to enjoy the park and forest facilities that have been provided

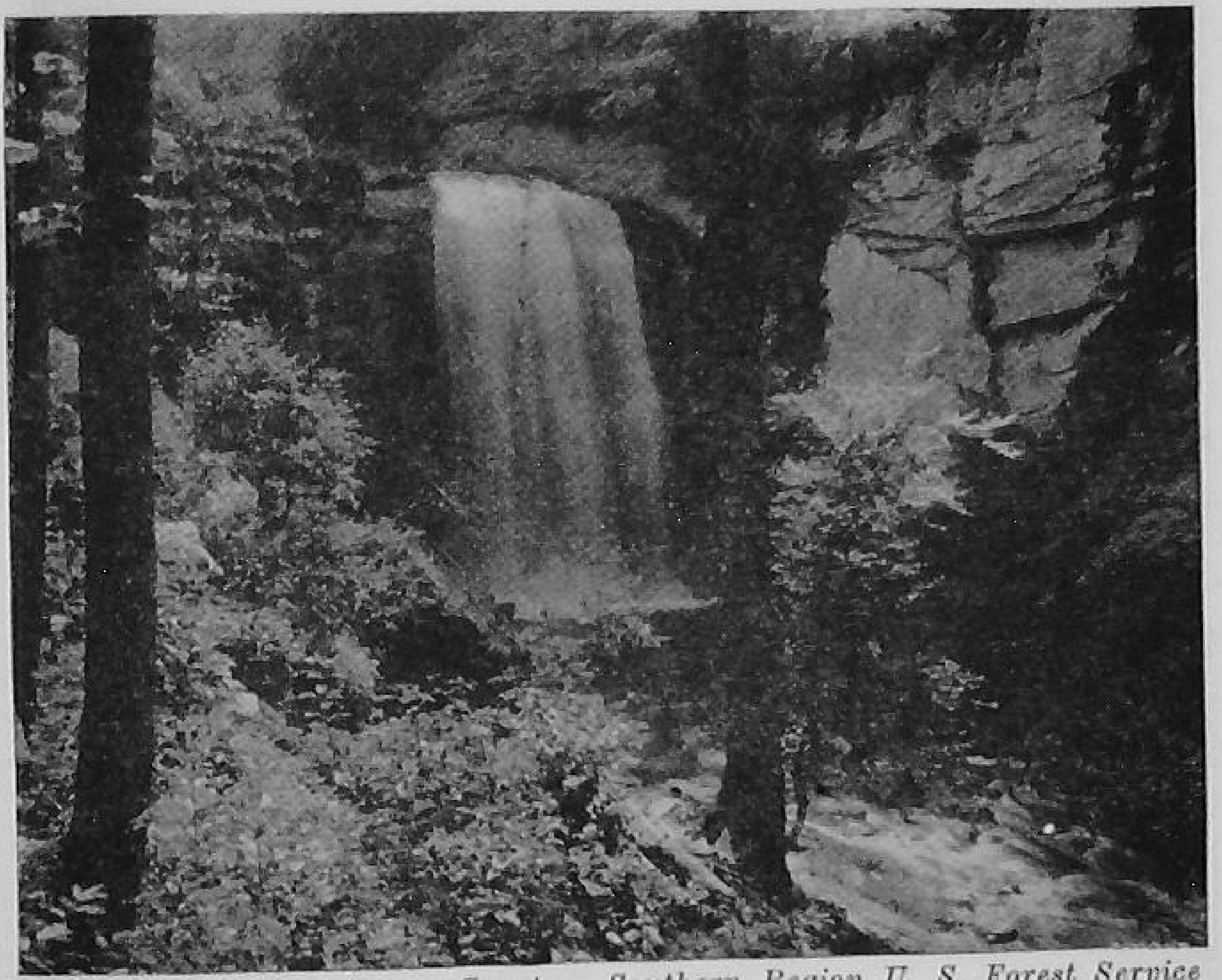
the past few years. With the help of the Civilian Conservation Corps, certain government agencies are setting up camps where children who would not otherwise get a vacation may go and spend a week or two and enjoy fishing, swimming, hiking, and living out of doors close to nature. Many civic clubs are also building such units for the children of their own cities, to get them away from the city streets. Boy Scout camps, Girl Scout camps, private camps, and educational camps established by state departments of education have appeared within the last few years.

We are a nation that year by year becomes more recreation-minded, and because of this, we will develop

a race of better citizens and stronger leaders in the world of men.

Forestry and Recreation in the South

The South is coming to be recognized as the playground of the nation. Each year thousands upon thousands of persons from all parts of North America come into the southern states. Some of these visitors stay only a few days; others come for the winter or for the season. They buy produce from our farms, create work for many who otherwise might be compelled to leave the South to find employment, and add in other ways to the income of our people. We wish to increase the number who look upon this section of the nation as a delightful place to visit, or in which to stay a portion of each year.

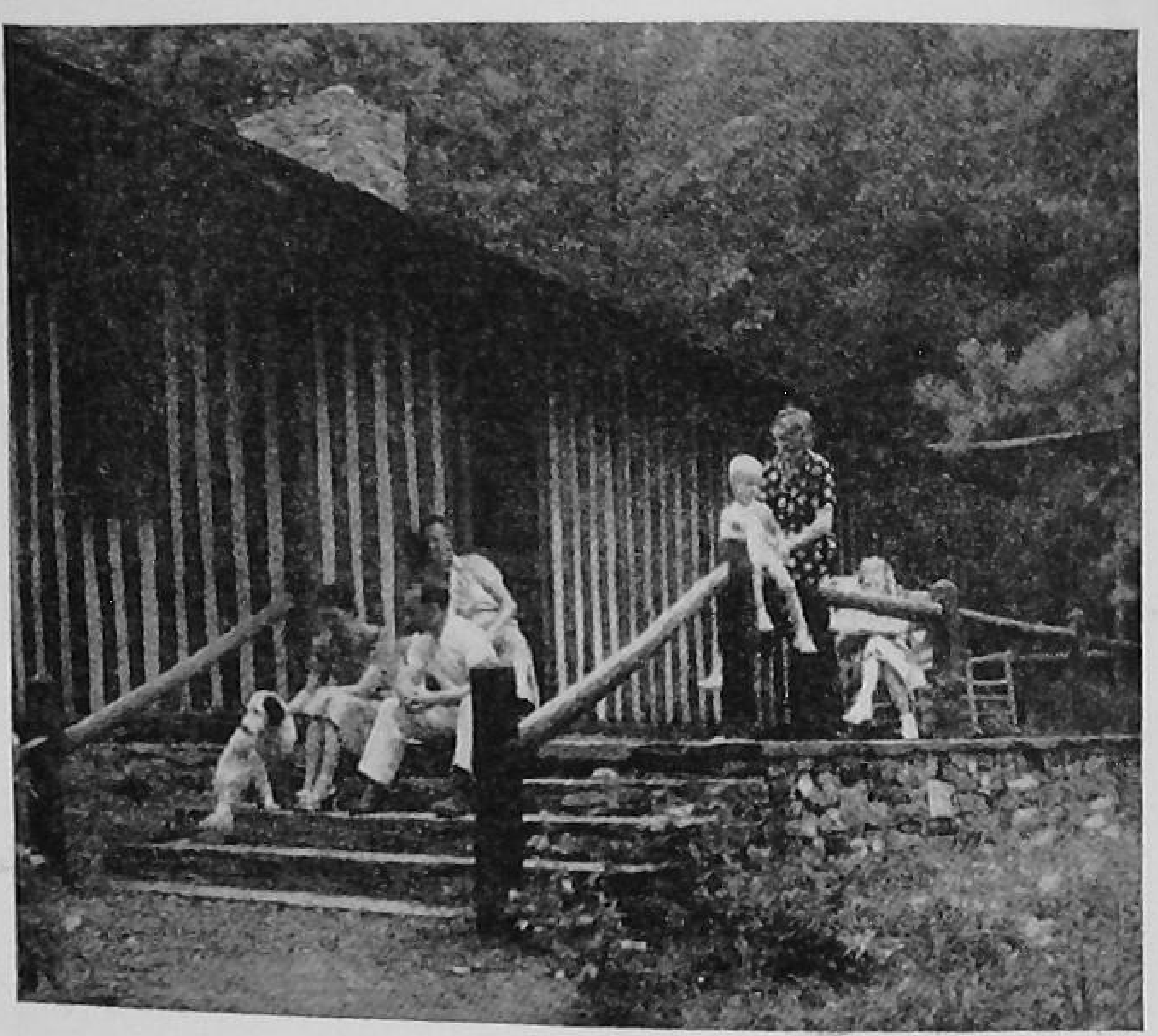


Courtesy Southern Region U. S. Forest Service

Southern Highlands Are Dotted with Beautiful Waterfalls

Why, we may ask, do these visitors like to come to the South? Why have the numbers increased so greatly in recent years?

First in importance is our climate—both winter and summer. We have a delightful, pleasant, comfortable



Virginia Conservation Commission

VIRGINIA'S STATE PARKS INVITE YOU

This is one of the cabins at Fairy Stone State Park near Bassett, Virginia. Some of the cabins overlook the 186-acre lake, which is well stocked with game fish

climate. Other sections of the country are just beginning to discover that fact.

Next, perhaps, we may say that our visitors seek recreation. They like to fish, hunt, play golf and other games, go swimming, and do all the other things which appeal to the play spirit in human beings.

Highlands Hammock State Park—Sebring, Florida

Climate and the opportunity which it affords to play, account, no doubt, for most of our visitors. But as an environment in which to play, we want our surroundings to be beautiful. Beauty, in any locality, consists largely of trees, flowers and shrubs, water, and topography. In all these things, the South is richly endowed. And there is nothing which adds more to the attractiveness of our parks and playgrounds than beautiful trees.

Courtesy Texas State Park System

DAVIS MOUNTAIN STATE PARK

The main lounge room of Indian Lodge is characterized by rustic construction of crude native timbers. The ceiling is bamboo poles and the floor random-width white oak

Like the pioneers in public recreation in California, we are striving to preserve and enhance the beauty spots of our section so that they may be enjoyed both by our own people and those who come to us for only brief visits. In the development of parks and recreational areas, we are making very rapid progress.

SOME SOUTHERN PARKS AND PLAYGROUNDS

Below are listed some of the state parks, the national forests, and other recreation areas in the southern states. The list is not complete, but it indicates that every person living in the South is near some playground. And it indicates, too, something of the scenic beauty and recreational facilities which this section of the nation offers for the entertainment of its visitors:

ALABAMA

Name of Park or Recreation Area	*Location*	*Description and Comment*
Cedar Creek (640 acres)	Citronelle	South Alabama. Rolling hills covered with forest. Lake. Swimming, boating, fishing.
Chattahoochee (590 acres)	Gordon	Southeast Alabama. Adjoining Chattahoochee River. Bounded by three states. Lake. Swimming, boating, fishing, hiking, Nature study. Unusual variety of plants.
Cheaha (2,200 acres)	Anniston	Alabama's highest mountain. Panoramic views, lookout tower, cabins, lake, trails, picturesque road.
Chewacla (500 Acres)	Auburn	High, wooded hills. Clear stream, lake, cabins, trails.
Chickasaw (480 acres)	Linden	Virgin pine forest in Piedmont. Roads, trails, picnic areas.
DeSoto (934 acres)	Fort Payne	Located on Lookout Mountain plateau. Clear stream in rock gorge. Picturesque trails, cabins, unique picnic areas. Fishing.
Gulf (3,350 acres)	Foley	On Gulf of Mexico. White sand beach. Contains three large fresh water lakes. Cabins. Salt and fresh water fishing. Most popular of Alabama's parks.
Little River (2,120 acres)	Uriah	High rolling forested hills and valleys. Lake. Cabins. Bathing facilities. Wilderness area.
May's Gulf (1,625 acres)	Fort Payne	Rocky gorge carved in Lookout Mountain plateau; 500 feet deep in places; river at bottom. Magnificent water falls; superb fishing. Trails.
Monte Sano (1,990 acres)	Huntsville	On top of beautiful mountain. Panoramic views. Deep cavern. Cabins.
Mound (175 acres)	Tuscaloosa	Indian mounds. Museum. Beautiful development.

THIS LOOKS LIKE A TROUT STREAM

But even though brook or rainbow refused to rise to a fly, this would be a delightful place to spend a day

Courtesy Southern Region U. S. Forest Service

A BOY SCOUT CAMP

This was built as a CCC Camp and turned over to the Boy Scouts as a permanent recreation home

Courtesy Southern Region U. S. Forest Service

A SUMMER VACATION

Southern forests attract thousands of visitors during the summer months. Here they may enjoy a delightful and inexpensive vacation

Name of Park or Recreation Area	*Location*	*Description and Comment*
Muscle Shoals (TVA Park) (2,846 acres)	Florence	On Tennessee River. Museum. Cabins, picnic areas, trails.
Oak Mountain (940 acres)	Birmingham	Development on top of Oak Mountain. Scenic splendor. Cabins. Trails.
Valley Creek (690 acres)	Plantersville	Forested, rolling hills. Beautiful tree growth. Lake. Cabins, trails, picnic areas.
Weogufka (809 acres)	Rockford	Mountains. Lookout tower. Cabins, roads, trails.
Wheeler Dam Reservation (1,500 acres)	Lawrence County	On Tennessee River. Beautiful area. Cabins and trails. Swimming and fishing.

Note; Other state recreation areas in Alabama include Bladon Springs State Park, Choctaw County; Bromley State Park, Baldwin County; Fort Toulouse State Park, Elmore County; Horseshoe Bend State Park, Tallapoosa County; Lagoons State Park, Montgomery County; Panther Creek State Park, Geneva County; Salt Springs State Park, Clarke County; Spring Villa State Park, Lee County; St. Stephens State Park, Washington County; Sumter State Park, Sumter County; Talladega State Park, Talladega County. Also, in Talladega National Forest, Horn Mountain Tower and Picnic Ground, Horse Block Mountain Tower and Picnic Ground; and in Black Warrior National Forest, Natural Bridge Picnic Grounds.

Arkansas

Name of Park or Recreation Area	*Location*	*Description and Comment*
Arkansas Post (62 acres)	Gillette	Historical area, the first white settlement above New Orleans in the Louisiana Purchase Area. Restoration. Picnic Area.
Buffalo River (920 acres)	Yellville	Beautiful mountain scenery, wonderful fishing, swimming in Buffalo River. Caves, springs, waterfalls.
Craighead County (3,420 acres)	Jonesboro	Unimproved wildlife refuge.
Crowley's Ridge (347 acres)	Walcott	On famous Crowley Ridge. A recreation area equipped for swimming, group camp facilities, outdoor amphitheatre.
Devil's Den (2,200 acres)	West Fork	A beautiful Ozark Mountain area, cave springs, crevasses, beautiful mountain stream, cottages, camp ground, bathing facilities.
Hot Springs National Park	Hot Springs	Preservation of springs believed to have healing properties.
Lake Catherine (2,000 acres)	Malvern	A lakeside park on beautiful Lake Catherine. Bass fishing, boating, swimming.
Mt. Nebo (3,375 acres)	Dardanelle	Beautiful, flat-top mountain elevation 1700 feet above sea-level. Cottages, trails, picnic and camping facilities.
Ouachita National Forest	Central and Western part of Arkansas extending into Oklahoma	This is a very beautiful region with dozens of camp grounds, picnic areas, Lake Sylvia (in northeast portion—location of Girl Scout Camp) and many recent improvements that make the Forest attractive to visitors. One of the larger national forests in this section of the United States.

Courtesy Southern Region U. S. Forest Service

A Beauty Spot in Mississippi

Name of Park or Recreation Area	*Location*	*Description and Comment*
Ozark National Forest	North and East of Ouachita National Forest	A beautiful area. With all facilities for visitors found in national forests. Hunting camps in portion of Forest. Springs, beautiful scenery, homes for summer visitors.
Petit Jean (2,630 acres)	Morrilton	An outstanding area of beautiful scenery, 100 foot waterfall, 400 foot canyon. Cottages. Swimming, hiking, picnicking.
J. B. Watson (100 acres)	Pine Bluff	Negro recreational area. Dormitories, recreation pavilion, athletic field.

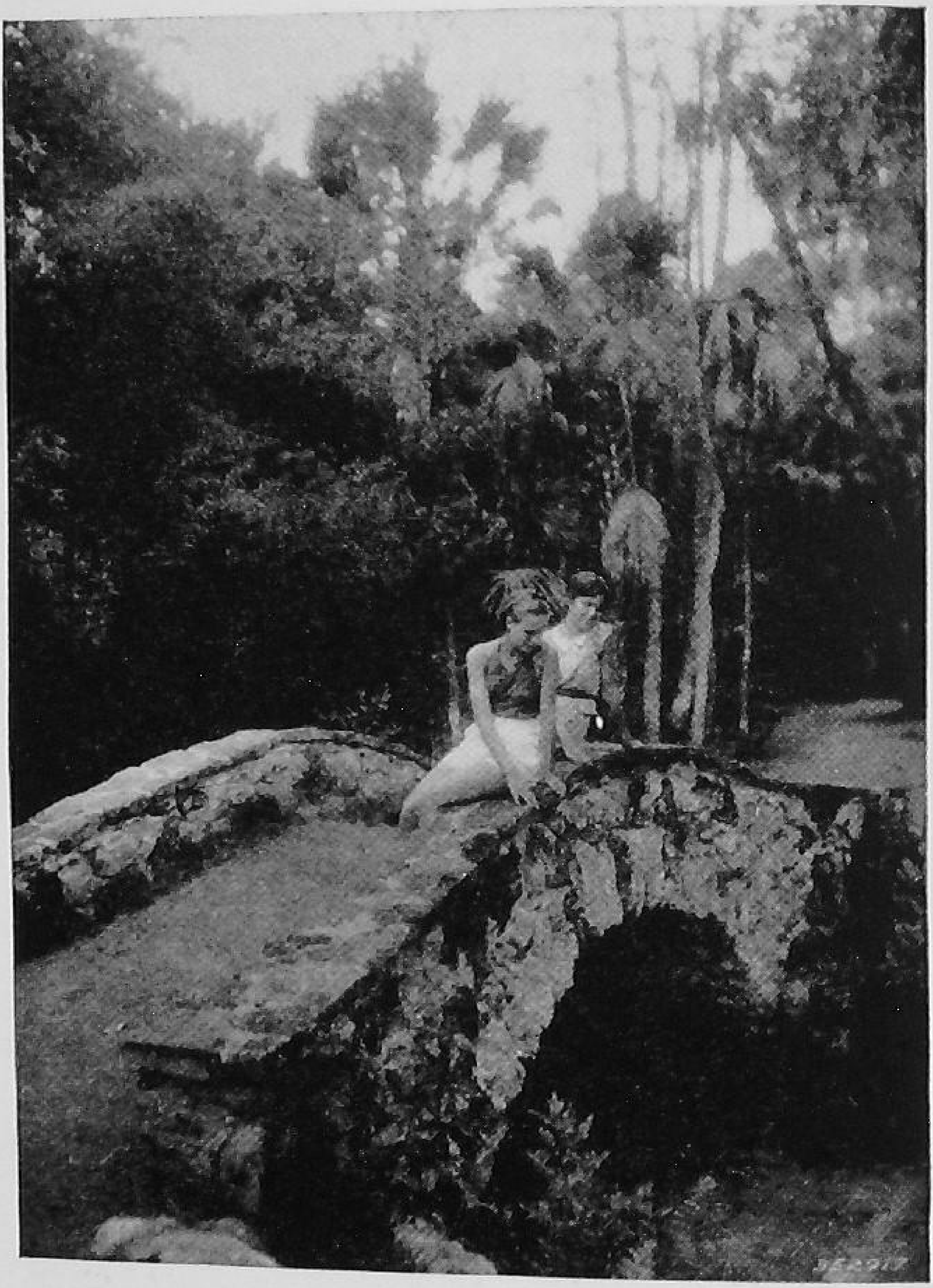
FLORIDA

Name of Park or Recreation Area	*Location*	*Description and Comment*
Choctawhatchee National Forest	Western part of State near Gulf	Complete recreation area, equipped for picnicking, swimming, boating, and camping. Beautiful grove of live oak on inland salt water bayou. Excellent site.
Everglades National Park (960,000 acres)	Florida City	Tropic everglades of southern Florida with unique plant and animal life. Notable for its many rare birds, abundance of unusual fish, mangrove forests of extraordinary height and impressiveness, traversed by inter-connecting waterways.
Florida Caverns (779 acres)	Mariana	Contains caverns adorned by exquisite stalactites and stalagmites. Said to equal many of the caverns in the Shenandoah Valley. Natural bridge formed by the Chipola River and a sky-blue spring. Picnic facilities.
Fort Jefferson National Monument (87 acres)	Florida City	Largest all-masonry fortification in western world. Built 1846 for control of Florida Straits. Federal military prison during and after the War Between the States. Bird refuge.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Fort Marion National Monument (19 acres)	St. Augustine	Oldest fort extant in the United States. Originally *Castle San Marcos.* Constructed of coquina by Spanish to defend their Florida possessions.
Fort Matanzas (36 acres)	St. Augustine	Early Spanish stronghold.
Gold Head Branch (1,800)	Keystone Heights	Located in the sand-hill lake region. Park of exceptional beauty. Clear sparkling stream and lakes. Sub-tropical trees, shrubs, palms, and flowers.
Highlands Hammock (1,105 acres)	Sebring	Sub-tropical jungle, one of the few remaining forests in the State where temperate and sub-tropical flora meet in a lush, vine-draped jungle. Rendezvous for Nature lovers. Natural bird and animal sanctuary.

Courtesy Southern Region U. S. Forest Service

CAMPERS IN A SOUTHERN NATIONAL FOREST



A WILDERNESS AREA

Across this rustic and attractive bridge these young ladies will find a wilderness area in this Florida forest which will appeal to them greatly if they are interested in beautiful, exotic plants

Courtesy Southern Region U. S. Forest Service

A VIEW FROM WAYAH BALD
Nantahala National Forest

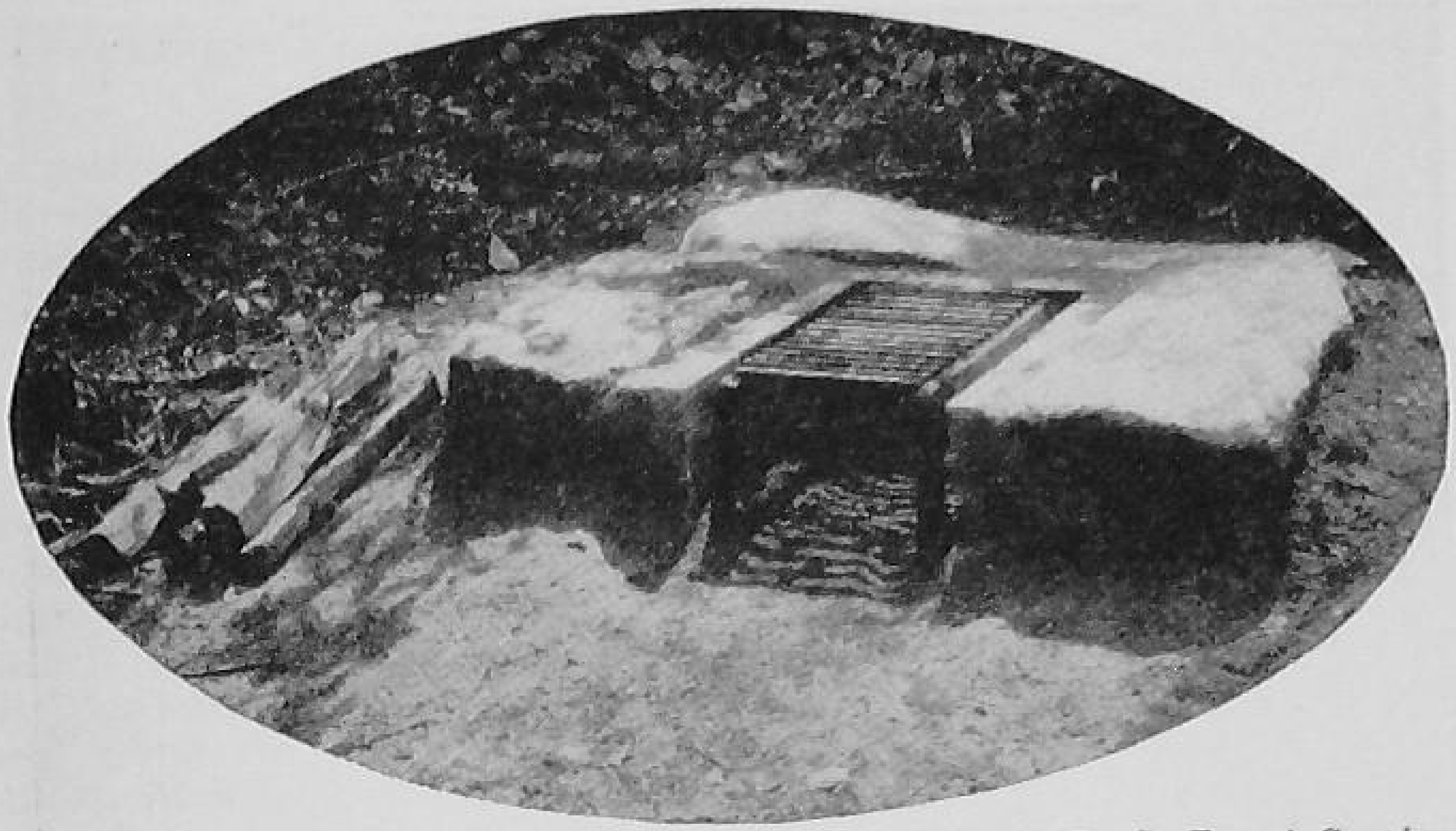
Name of Park or Recreation Area	*Location*	*Description and Comment*
Hillsborough River (720 acres)	Zephyrhills	Traversed by crystal-clear Hillsborough River with its rapids, which, during low-water periods are audible throughout the park. An area of outstanding beauty with large trees of many species.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Myakka River (8,300 acres)	Sarasota	Pronounced by authorities as one of the finest wildlife sanctuaries in the eastern United States. Picnic areas, trails, cabins.
Ocala National Forest	North-Central part of State	Many recreation areas including Deer Lake Camp with 14 cabins, mess hall, play facilities and bathing beach on lake. Available to private and semi-public organizations; also Juniper Springs, flowing 10 million gallons of water per day, with all developments for recreation.
Osceola National Forest	Northern part of State	Osceola Lodge Administrative Unit. Two-story log building which may be secured for small groups wishing water frontage, by special arrangement with the Forest Supervisor.
Spanish War National Memorial	Tampa	Proposed memorial of Davis Island, commemorating the services of the American soldiers in the War with Spain. The major part of the U. S. Army embarked for Cuba from a nearby point.
Suwanee River (1,621 acres)	Ellaville	On the banks of the Suwanee River, famed in song and story.
Torreya (520 acres)	Rock Bluff	Botanist's paradise. Torreya and Yew tree found in and around this park exist nowhere else in the world. Picnicking, swimming, hiking.

Note: In addition to the parks, forests, and recreation centers listed there are countless hunting and fishing camps open to the Florida visitors and residents. Many hunting camps near the Ocala National Game Refuge are open to hunters in season.

Georgia

Alexander H. Stephens Memorial (263 acres)	Crawfordville	Home of Alexander H. Stephens, Vice-President of the Confederate States. Swimming, boating, hiking, picnic areas.



Courtesy Southern Region U. S. Forest Service

A STEAK STOVE FOR CAMPERS

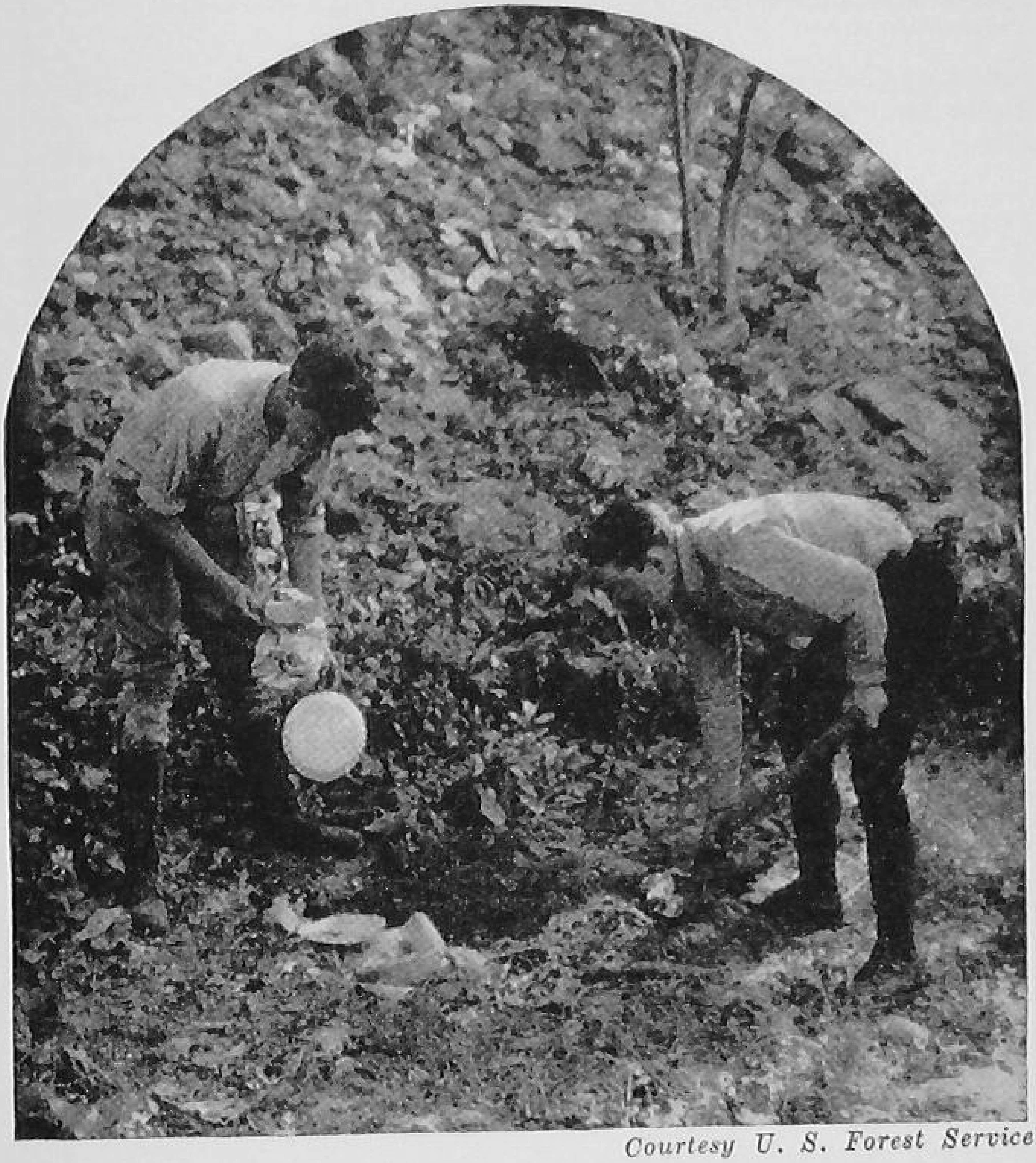
Name of Park or Recreation Area	*Location*	*Description and Comment*
Chattahoochee National Forest	Union, Rabun, Murray, Lumpkin, White, and Fannin Counties	This national forest contains many scenic spots that are most attractive, numerous picnic areas, some lakes where swimming and boating may be enjoyed, and countless inviting trails. It is located in the northeastern portion of the State.
Chehaw (600 acres)	Albany	Land of Chehaw Indian tribe. Large lake. Boating, swimming, fishing, picnic areas.
Chickamauga (8,584 acres)	Georgia and Tennessee	Historic significance as battlefield in War Between the States.
Fort Frederica (80 acres)	Brunswick	Built in 1736 by General Oglethorpe as an outpost against Spain.
Fort Mountain (2,070 acres)	Chattsworth	Site of unidentified prehistoric ruins. Swimming, hiking, picnic facilities. Cabins.
Fort Pulaski (427 acres)	Savannah	Historic fortification.

Courtesy Southern Region U. S. Forest Service

AN INCINERATOR IN A NATIONAL FOREST

Every precaution is taken to keep the forest clean, sanitary, and attractive

Name of Park or Recreation Area	*Location*	*Description and Comment*
Indian Springs	Indian Springs	Spring of reputed medical properties, deeded by Creek Indians to Georgia. Museum. Picnic facilities, trails, virgin hardwood forest.
Jefferson Davis Memorial (8 acres)	Irvinville	Commemorating spot where Jefferson Davis performed his last official duties as President of the Confederate States of America. Museum.



Courtesy U. S. Forest Service

GOOD CAMP SANITATION

These young men in their desire to keep the forest sanitary and attractive are burying their trash. Do you think everyone should follow their example?

Name of Park or Recreation Area	*Location*	*Description and Comment*
Kennesaw Mountain (170 acres)	Marietta	Site of two heavy assaults made by Sherman on Confederate troops in the Atlanta Campaign.
Little Ocmulgee (1,395 acres)	McRae	Wide variety of floral beauty. 250 acre lake. Picnic facilities, swimming, fishing.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Ocmulgee National Monument (688 acres)	Macon	Preservation of prehistoric site and ruins.
Pine Mountain (1,550 acres)	Chipley	Unusual geological formation. Scenic beauty. Lake. Swimming, boating, picnic facilities. Cabins.
Santo Domingo (350 acres)	Brunswick	Site of ruins of Spanish or colonial origin. Natural coastal plantatorium. Trails, picnic areas.
Vogel	Neel Gap	Northern part of state, very beautiful mountains, outstanding scenic beauty. Lake, store, cabins, trails, picnic facilities.
	KENTUCKY	
Abraham Lincoln National Park (110 acres)	Hodgenville	Memorial building covering log cabin believed to be that in which Lincoln was born.
Audubon Memorial State Park (478 acres)	Henderson	Named in honor of John James Audubon. Natchez and Indian Trails bound the park. Museum will house priceless collection of Audubon prints. Park a portion of land owned by famous Transylvania Company. Camping and public facilities.
Blue and Gray State Park (87 acres)	Elkton	Almost midway between birthplaces of Lincoln and Jefferson Davis. Great variety of trees and wild flowers. Especially equipped for camping groups, club meetings, etc.
Blue Licks State Park (37 acres)	Mt. Olivet	Scene of last battle of Revolution. April 19, 1782. Unusual collection of prehistoric bones and Indian relics housed in Museum. Mastodons and prehistoric monsters found in salt licks. Camping area.
Butler Memorial State Park (321 acres)	Carrolton	Named for General William Orlando Butler. The Bluegrass Park. Contains old Butler Mansion. Recreational Area.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Columbus-Belmont State Park (361 acres)	Columbus	Overlooks Mississippi River. Historic. Recreational, with camping facilities.
Constitution Hall	Danville	In this old brick building were held nine conventions to decide the future of the embryo Kentucky, the first held in 1784.
Cumberland Falls State Park (593 acres)	Cumberland Falls	Mountain scenery. Falls in Cumberland River 68 feet high. Moonbow in full moon observed only at one other place on earth, in South Africa. Recreational facilities and features.
Cumberland National Forest	Pine Ridge	Pine Ridge Forest Camp. Camp site development includes fine acres of gently rolling ridge tops. By short drives and walks from this camp site, one may view spectacular formations. Picnic facilities in connection with lookout tower are available.
Dawson Springs State Park (458 acres)	Dawson Springs	Wooded area. Lakes and streams, camping, picnicking and other facilities.
Jefferson Davis Monument (20 acres)	Fairview	Monument 351 feet high, marking the place where Jefferson Davis was born in 1808. Elevator to top of monument. Replica of house in which Davis was born.
Levi Jackson State Park (375 acres)	London	Scene of Indian massacre, "Defeated Camp." Historical. Mountain handweaving. Saddle horses. Foot and Bridle trails. Picnic areas with outdoor ovens. Museum one of most outstanding in Kentucky.
Lincoln Cemetery Memorial (3 acres)	Vine Grove	Old cemetery where Lincoln's grandmother, Bersheba and four other members of the Lincoln family are buried.
Lincoln Homestead Monument (22 acres)	Springfield	This area embraces the original home of Abraham Lincoln, Sr. Also the house of Richard Berry and other Lincoln monuments.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Mammoth Cave National Park (34,620 acres)	Cave City	Largest known caverns in United States. Discovered about 1798. With huge passageways. Furnished saltpeter for gunpowder in 1812. Prehistoric Indian mummy discovered in 1935.
My Old Kentucky Home State Park (235 acres)	Bardstown	"Federal Hill," built by Judge John Rowan in 1795. Where Stephen Collins Foster wrote "My Old Kentucky Home." Many of original furnishings.
Natural Bridge State Park (1,137 acres)	Natural Bridge	Huge, unusual stone bridge. Rugged mountain scenery. Other outstanding geological formations. Picturesque trails. Lodge. Bathing, boating, fishing. Lake. Picnicking.
Old Mulkey Meeting House Shrine (30 acres)	Tompkinsville	Oldest wooden building of its kind in Kentucky. Built in 1798 of half-hewn logs and chinking.
Perryville Battlefield State Park (17 acres)	Perryville	Scene of bloodiest battle ever fought in Kentucky. Many Federals and Confederates buried here and monuments have been erected to both sides.
Pine Mountain State Park (2,500 acres)	Pineville	First state park of Kentucky. Mountain scenery. Natural amphitheatre, scene of yearly mountain laurel festival. Lake for fishing, boating and bathing. Picnic areas.
Pioneer Memorial State Park (18 acres)	Harrodsburg	Replica of old Fort Harrod, honoring pioneers who settled there in 1774. Collection of pioneer firearms, furniture, tools and household utensils.
Pioneer National Monument	Lexington Winchester Paris	Four proposed areas in Kentucky—Fort Boonesborough, Boone's Station, Bryan's Station and Blue Licks Battlefield.—commemorating the heroism of the American pioneers under the leadership of Daniel Boone.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Walker Memorial State Park (12 acres)	Barbourville	Replica of first log cabin to be occupied by a white man in Kentucky. Originally built by Dr. Thomas Walker in 1760. Camping area in park.
Wm. Whitley Homestead Park (10 acres)	Stanford	First brick house west of Alleghenies. Built by Col. Wm. Whitley. Also first circular race track in country also built by Col. Whitley.

Louisiana

Chalmette Monument and Grounds (15 acres)	New Orleans	Part of the ground on which the Battle of New Orleans was fought January 8, 1815.
Chemin-A-Haut (500 acres)	Morehouse Parish	Bayous and wooded hills. Camping and picnicking facilities. "High Road" of the French of early Louisiana.
Fort Pike (125 acres)	Tammany Parish	Old Fort Pike still preserved in excellent condition.
Longfellow-Evangeline (157 acres)	St. Martin Parish	Commemorative of the story of Evangeline written by Longfellow. Very beautiful country.
Kisatchie National Forest	Alexandria	Among the more important recreation centers in Kisatchie National Forest are: Big Creek Recreation Area, swimming, camping, picnicking; Lake Valentine, 70-acre lake, rental summer colony; Saline Lake Fishing Camp, a flooded forest with camp sites along shore.

Mississippi

Ackia Battleground (50 acres)	Tupelo	Site of Indian village of Ackia, where in 1736 Chickasaw Indians aided the English troops and repulsed attack of French and their Choctaw allies.
Clarkco State Park (794 acres)	Quitman	Longleaf pine section of State. 70-acre artificial lake. Rolling hills. Cabins, picnic facilities.

Name of Park or Recreation Area	*Location*	*Description and Comment*
DeSoto National Forest	Southeastern Mississippi	Contains many attractive recreation areas including Ashe Lake, by Biloxi, and Thompson Creek. Well developed recreation facilities.
Holmes County State Park (463 acres)	Durant	Rolling hills, forest of pine, oak, gum and great variety of native shrubs and wild flowers. Excellent facilities.
Legion State Park (439 acres)	Louisville	Rolling hills, lakes, facilities for camping, picnicking, fishing, and swimming.
LeRoy Percy State Park (2,701 acres)	Hollandale	Typical of Mississippi Delta. Virgin hardwood forests. Bayous. Cabins, lodge, fishing, swimming.
Percy Quin State Park (1,480 acres)	McComb	500-acre lake, fed by Tangipahoa River. Cabins, lodge. Beautiful setting.
Roosevelt State Park (494 acres)	Morton	100-acre spring fed lake, rolling hills, pine and hardwood forests, excellent facilities. Picnicking, boating, swimming.
Spring Lake State Park (855 acres)	Holly Springs	Beautiful lake, fed by springs. Excellent fishing.
Tishomingo State Park (980 acres)	Tishomingo	Outstanding scenic park of state. Parkway connects park with Natchez Trace Parkway.
Tombigbee State Park (522 acres)	Tupelo	Rolling hills, hardwood forests, 70 acre lake. Modern facilities.
Vicksburg National Military Park (1,214 acres)	Vicksburg	Remarkably preserved fortifications of 47 day seige of Vicksburg during War Between States.

North Carolina

Cape Hatteras State Park (1,100 acres)	Buxton	On famed North Carolina "banks" includes Cape Hatteras and surrounds old Cape Hatteras Lighthouse.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Fort Macon State Park (500 acres)	Morehead City	Includes historic Fort Macon, which has been partially restored and is notable for its fine detail and excellent workmanship. Includes over two miles of ocean shore and beautiful cedar and youpon growth.
Great Smoky Mountains National Park (411,688 acres)	Asheville	Loftiest range east of Black Hills, South Dakota, and as a natural arboretum and herbarium, one of the world's most diversified.
Guilford Courthouse National Military Park (137 acres)	Greensboro	Site of an important encounter between British and American forces on March 15, 1781.
Hanging Rock State Park (3,000 acres)	Danbury	In Sauratown Mountains in upper Piedmont area of North Carolina. Fine panoramic views. Includes several beautiful streams and waterfalls and very interesting rock formations.
Kill Devil Hill Monument (314 acres)	Elizabeth City and Kitty Hawk	Site of the first sustained flight by a heavier than air machine, made by Wilbur and Orville Wright.
Moore's Creek National Military Park (30 acres)	Burgaw Wilmington	Scene of a memorable battle between North Carolina Whigs and Tories, in 1776.
Morrow Mountain State Park (3,200 acres)	Albemarle	In unique Uwharrie Mountains. Includes beautiful hills and rolling country and fine views of Pee Dee River. Includes territory of distinctly mountainous appearance.
Mount Mitchell State Park (1,224 acres)	Black Mountain	Located in Black Mountains. Includes highest point east of Mississippi River. Virgin spruce and fir forest, interesting northern forest growth. Views and scenery unsurpassed in southern Appalachians.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Nantahala National Forest	Southwestern North Carolina (Franklin, Highlands)	One of the most beautiful of the National Forests. Popular summer resorts. Scenic grandeur—lakes, forests, mountains.
Pisgah National Forest	Southwestern North Carolina (Asheville)	In the "land of the sky" country. Very beautiful. Popular resort country. High peaks, big trees, beautiful flowers. All recreation facilities.
Rendezvous Mountain State Park (142 acres)	North Wilkesboro	Gathering place for Wilkes county patriots who fought in the battle of Kings Mountain.
OKLAHOMA		
Beavers Bend (1,250 acres)	Broken Bow	Located in the Kiamichi Mountain region in the timber belt of the southeastern part of the State. Mountains, trees of all kinds, excellent hunting and fishing.
Boiling Springs (900 acres)	Woodward	This area is noted for abundant timber and large springs. Has more than 40 varieties of trees and shrubs.
Lake Murray (20,000 acres)	Ardmore	Rugged rock formation. Of geological interest, Arbuckle uplift.
Osage Hills (720 acres)	Pawhuska	Located in the Osage Indian Reservation. Very rich in lore of these people, the nation's wealthiest Indian tribe.
Robbers Cave (9,000 acres)	Wilburton	Built around a large cave which was a hideout for early Indian-Territory outlaws, including Belle Starr. Mountainous.
Roman Nose (720 acres)	Watonga	The home of a former Chief of the Cheyenne Indians. Semi-arid region of most interesting formations.
Spavinaw Hills (1,520 acres)	Spavinaw	Limestone hill formation with rugged mountains. Formerly a fine hardwood forest.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Quartz Mountain (720 acres)	Lugert	Rocky terrain, rugged mountains of granite formation rising above the plains in a series of rounded knobs and peaks separated by rugged gulches.

Note: In Oklahoma will be found the Platt National Park, Sulphur and Davis Counties, noted for its springs, including the only bromide springs in the world; also parts of the Quachita National Forest with many points of interest including picnic grounds at Horse Thief Spring and Billy Creek.

South Carolina

Aiken State Park (867 acres)	Windsor	Typical scenery of surrounding country. Recreational area on upper Edisto River.
Castle Pinckney National Monument (3½ acres)	Charleston	Part of the early defense of Charleston Harbor.
Cheraw State Park (700 acres)	Cheraw	Typical longleaf pine, sandy country. Recreational area.
Chester State Park (522 acres)	Chester	Typical piedmont rolling country. Large lake. Boating, fishing, picnicking.
Cowpens National Battlefield (1 acre)	Cowpens	Site of Daniel Morgan's decisive victory over the British Banastre Tarleton on January 17, 1781.
Edisto Beach State Park (1,255 acres)	Edisto Island	Beautiful beach on Atlantic Ocean. Tropical vegetation. Indian mound.
Eutaw Springs	Eutawville	Site of Revolutionary battle fought Sept. 8, 1781.
Francis Marion National Forest	On Atlantic Seaboard, north of Charleston	Nice hammock along waterway affords place for overnight stops or day picnicking, tourists and local people. Old plantation acres, ancient grove of Live Oaks. Provisions simple.
Givhans Ferry State Park (1,235 acres)	Ridgeville	Scenic beauty, on banks of Edisto River, most beautiful river in South Carolina. Bathing, fishing, picnicking, cabins.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Kings Mountain National Military Park (40 acres)	Kings Mountain	Site of an American victory at a critical point in the Revolutionary War Oct. 7, 1780.
Lee State Park (2,109 acres)	Bishopville	Beautiful inland wooded area. Natural arboretum.
Myrtle Beach State Park (320 acres)	Myrtle Beach	Beautiful beach on Atlantic Ocean. Recreational area, bath house, cabins, picnic area, trailer camp.
Oconee State Park (1,165 acres)	Walhalla	Outstanding mountain scenery. Lake swimming, boating, cabins, picnicking.
Paris Mountain State Park (1,275 acres)	Greenville	Natural mountainous scenic beauty. Recreational area. Camp Group. Lakes. Bath house.
Poinsett State Park (1,000 acres)	Wedgefield	Inland park. Natural arboretum, including mountain and coastal plants. Recreational Lake. Bath house, cabins, picnic areas and trailer camp.
Sesqui-Centennial State Park (1,500 acres)	Columbia	Typical inland area. Recreational area.
Sumter National Forest	Northwestern portion of state. (Newberry, Walhalla, Oconee County)	Where mountains of South Carolina begin. Picnic area, fine spring, stream, swimming pool, large trees. Walhalla Fish Hatchery.
Table Rock State Park (2,680 acres)	Pickens	Rugged mountainous scenery of exceptional beauty. Clean streams, mountain lake.
TENNESSEE		
Andrew Johnson National Monument (1 acre)	Greeneville	Site of Andrew Johnson homestead and tailor shop in which he worked as a young man in Greeneville.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Backbone Rock Recreation Area	Johnson City	On Beaver Dam Creek, in Cherokee National Forest. Spectacular flat-topped rib of rock penetrated by an old railroad tunnel, the rock rib forming a sharp bend in Beaver Dam Creek. Picnicking, swimming, hiking and nature study.
Beaver Dam Recreation Area	Johnson City	For colored people. In Cherokee National Forest. One mile down-stream from Backbone Rock. Provisions for picnicking, swimming and camping for colored people.
Big Ridge Park (4,500 acres)	Union County	On Norris Lake. Reached from Knoxville or Norris, Tennessee. Swimming, fishing, boating, hiking. 42-acre lake. Cabins. Camping and trailer facilities. Lodge. Picnic areas.
Buffalo Springs Game Farm (450 acres)	Grainger County	Game farm, with clear streams, large hatching and rearing facilities. Small sites for picnicking.
Caryville Park (400 acres)	Campbell County	Public service facilities. Operated under TVA.
Cherokee National Forest	Extreme northeastern and southeastern part of state. (Counties: Carter, Unicoi, Greene, Monroe, Polk.)	Forested flat on mountain stream. Fine grove of white pines. Densely-wooded mountain valley. Large coves. Picnic area, swimming, trails for hiking, camping sites. Place for nature study. Spectacular waterfall on Bald River. Wooden Conservatory.
Chickasaw Forest (11,462 acres)	Henderson	92-acre lake. All sports. Foot trails. Cabins. Picnicking. Swimming. Camp. Lodge.
Clinch River Park (4,000 acres)	Union County	Public service facilities. Operated under TVA.
Cove Lake State Park (850 acres)	Campbell County	Proposed area.
Cumberland Homesteads Park (1,500 acres)	Crossville	Lake, cabins, picnicking, high on the Cumberland Plateau.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Falls Creek Falls Recreation Area (15,559 acres)	Pikeville	High on Cumberland Plateau. For organized group camping.
Fort Donelson National Military Park (93 acres)	Erin	Site of Civil War Fort. Well preserved example of typical Civil War semi-permanent fortifications.
Great Smoky Mountains National Park (411,688 acres)	Knoxville	Loftiest range east of Black Hills, South Dakota, and as a natural arboretum and herbarium, one of the world's most diversified.
Grundy State Forest (211 acres)	Grundy County	Picnic areas. Lake. Swimming.
Meriwether Lewis National Monument (300 acres)	Hohenwald	Site of old Grinder's Inn on the Natchez Trace where Meriwether Lewis is buried.
Montgomery Bell Recreation Area (3,814 acres)	Dickson County	For organized group camping.
Natchez Trace Forest (43,000 acres)	Lexington	297 acres in lakes. Foot trails. Accommodations. Cabins. Camping. Lodge and picnic areas.
Norris Park (3,800 acres)	Norris	At Norris Dam, near Knoxville. Swimming, boating, fishing, hiking, riding. Cabins. Camping and trailer facilities. Recreation area.
Pickett Forest State Park (11,500 acres)	Jamestown	Horse trails. Foot trails. Eleven-acre lake. Caves. Natural bridges. Rugged scenery. Cabins. Camps. Trailer facilities. Picnic areas.
Pickwick Dam Reservoir Park (1,700 acres)	Shiloh	Near Shiloh National Military park. Swimming, boating, fishing, hiking. On shore line of Reservoir Lake. Camping and trailer facilities. Picnic areas.
Quinn Springs Recreation Area	Benton	Where Hiawassee River breaks through the mountains. Sheltered coves with springs along highway afford fine opportunities for picnicking, camping and hiking.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Reelfoot Lake Game Preserve (19,842 acres)	Tiptonville	Earthquake formed. As nature left it. Hunting, fishing, boating, swimming. Guides and boats available. Numerous cottages and camps around lake.
Shelby Forest Recreation Area (12,314 acres)	Shelby	For organized group camping. On Mississippi River.
Shiloh National Military Park (3,717 acres)	Corinth	Natural park embracing the battlefield of Shiloh near Pittsburg Landing. Also finely preserved Indian Mounds.
Standing Stone Forest (8,500 acres)	Livingston	Swimming, fishing, boating, hiking, riding. 60-acre lake. Lodge. Cabins. Picnic areas. Camping and trailer facilities.
Stone's River National Military Park (324 acres)	Murfreesboro	Scene of a stubbornly fought mid-winter battle in 1862. Considered one of the most sanguinary battles of the War Between the States.
	TEXAS	
Balmorhea (950 acres)	Toyahvale	Includes Solomon Springs, which has a daily flow of 23 million gallons; largest outdoor swimming pool in State. Swimming, boating, fishing, picnicking.
Bastrop-Buescher (4,000 acres)	Bastrop	One of best planned and best developed parks of the Southwest. Refectory building, cottages, boating, swimming, golfing. Both pine and hardwood forest.
Big Ben (145,000 acres)	Marathon	In Chisos Mountains. Largest, most stupendous natural outdoor playground in Texas, practically unknown, yet one of the points first settled by white men. Very interesting.
Big Spring (554 acres)	Big Spring	One of the outstanding parks of West Texas. Elevation 2,811 feet. Big Spring and "Scenic Mountain" are features. Open air pavilion, picnic facilities.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Blanco (110 acres)	Blanco	Improved and made accessible by State Park Board and National Park Service. Very interesting. Limited overnight accommodations.
Bonham (532 acres)	Bonham	Attractive park three miles from Bonham. No overnight accommodations.
Brownwood (538 acres)	Brownwood	In big bend of Brownwood Lake, every recreation facility available, including 16 stone tourist cabins, 15 picnic units. Swimming, boating, hunting, fishing. Trails and roads.
Caddo Lake (35,000 acres)	Karnak	Main park site on shore of Cypress Bayou, which flows into Caddo Lake, which has an area of 35,000 acres. Has overnight accommodations, camp sites, log cabins, guides, canoes, boats, and all camping and fishing accommodations. A very interesting park.
Cleburne (508 acres)	Cleburne	A lake of 135 acres on the West from Camp Creek. Has all facilities for visitors and tourists, except overnight accommodations.
Davis Mountains (5,700 acres)	Ft. Davis	Interesting park. Every possible provision made for visitors. Accommodations at Pueblo Indian Lodge; 20 separate apartments.
Daingerfield (500 acres)	Daingerfield	Picnic facilities; no overnight accommodations. Still under construction with many improvements planned.
Fort Parker (1,400 acres)	Limestone County	Very large dam, making large lake with swimming, boating, fishing, and other recreation facilities. Also contains old Fort Parker of great historic interest.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Garner (478 acres)	Uvalde	Elevation 1,380 to 2,000 feet. In Frio Canyon. A scenic masterpiece any time during the year.
Goose Island (157 acres)	Rockport	Gulf Coast Country. Island and mainland connected, very interesting and delightful. Refectory building, picnic shelter, roads, and other developments.
Gonzales-Palmetto (300 acres)	Ottine	A tropical area placed in a western setting. Most interesting of flower preserves in Texas found here, hills, valleys, lakes, and swamp areas, all covered or contain choice specimens of rare and little-known varieties.
Hereford (540 acres)	Hereford	Fireplaces, tables, benches, and other picnicking facilities, but no overnight accommodations.
Lake Corpus Christi (2,000 acres)	Mathis	Picnic and recreation facilities. Lake formed by huge dam across the Nueces River. No overnight accommodations.
Longhorn Cavern (550 acres)	Burnet County	Very interesting cavern. Tours through the cavern conducted by capable and well-informed guides daily. Picnic facilities. Overnight accommodations at Burnet and Marble Falls.
Mackenzie (550 acres)	Lubbock	Concrete swimming pool, bathhouse, 18-hole golf course, and numerous picnic units. The head of the Brazos River.
Mother Neff (256 acres)	McGregor	First park donated to State of Texas in the development of the State Park System by Governor Pat M. Neff, son of Mrs. Isabella Neff. The site of an old picnic ground and place where protracted meetings had been held for many years. Well developed with recreation facilities.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Palo Duro Canyon (15,103 acres)	Randall and Armstrong Counties	One of the chief scenic wonders of Texas. Altitude 3,600 feet. As colorful as the Grand Canyon. Has every facility for visitors.
Tyler (985 acres)	Tyler	75-acre lake, overnight cabins; picnic units; concession building. Beauty spots developed by State and National Park Service.

Note: The parks listed include only a few of those included in the Texas State Park System. In all, there are 250,000 acres of land in about 50 parks, which have cost many millions of dollars. Complete information concerning any or all these recreation centers may be obtained from the Texas State Park Board, Austin. Texas also contains the Sam Houston National Forest; Sabine National Forest; Angelina National Forest; and the Davey Crockett National Forest. Detailed information about these areas may be secured from the U. S. Forest Service.

Virginia

Colonial Historic Park (6,302 acres)	Williamsburg Lee Hall	Includes Jamestown Island, the site of the first permanent settlement in North America, parts of the city of Williamsburg and Yorktown, where in 1781, the French and Americans besieged and captured Cornwallis' army in the last important battle of the revolution.
Douthat State Park (4,980 acres)	Clifton Forge	Heart of Alleghany mountains. Outstanding example of Virginia's mountain scenery. 78 acre lake. 25 log cabins. Nature study, with unusual amount of wildlife. Swimming, boating. Picnicking.
Fairy Stone State Park (5,000 acres)	Bassett	From the lucky stone crosses, or fairy stones. One of most attractive state parks. 168 acre lake. Picnicking, swimming, boating, fishing, Nature study.
Fredericksburg and Spotsylvania County Battlefields Memorial (2,285 acres)	Fredericksburg	Six great battlefields of the War Between the States in the vicinity of Fredericksburg, containing miles of original trenches and earthworks and a fine museum.

Name of Park or Recreation Area	*Location*	*Description and Comment*
George Washington Birthplace (394 acres)	Fredericksburg	Memorial mansion and gardens on the site of Washington's birthplace.
George Washington National Forest	Extreme mid-western part of State.	Mountainous section of State. 22 acre lake. Ruin of old Elizafield furnace. Woodstock tower. Camping, picnicking, swimming, fishing, mountain climbing. Organized camping units.
Hungry Mother State Park (2,400 acres)	Marion	Elevation of park about 2200 feet. Large lake. Sand beach. Swimming. Fishing. Cabins. Picnic areas. Scenic wonderland. Nature study.
Jefferson National Forest	Southwestern part of state along boundary.	Mountainous. Includes "The Natural Tunnel" country. Superb views. Swimming. Fishing. Hiking. Recreation facilities.
Matoaka State Park (1,200 acres)	Williamsburg	Administrative authority is William and Mary College.
Patrick Henry National Monument	Brookneal	Consists of Red Hill, the estate of Patrick Henry. Commemorating the vital part played by Patrick Henry in the early history of this nation.
Petersburg National Military Park (1,850 acres)	Petersburg	Interesting battlefield area and scene of the longest siege in the history of the United States, about 100 miles of well preserved earthworks.
Seashore State Park (3,800 acres)	Cape Henry	On Chesapeake Bay. Collection of lakes. Sand dunes. Beaches. Aquatic sports. Cabins. Swimming. Fine fishing. Trails. Picnic areas. Few miles from Virginia Beach.
Shenandoah National Park (180,571 acres)	Sperryville Warrenton Luray Charlottesville	Embraced outstanding scenic section of the Blue Ridge Mountains.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Staunton River State Park (1,776 acres)	South Boston	Near Occaneechee Island, famous Indian trading post. One of largest swimming pools in state. Located at confluence of Dan and Staunton Rivers. Modern bathhouse. Cabins. Picnic areas. All modern conveniences.
Westmoreland State Park (1,266 acres)	Montross	One of state's most historic areas. Bounded by Potomac River, with excellent river beach. Cliff background. Trails. Picnic shelters. Cabins. Nature study.

West Virginia

Name of Park or Recreation Area	*Location*	*Description and Comment*
Babcock (3,616 acres)	Lewisburg	2,600 feet above sea level. Most spectacular of West Virginia's State Parks. Unsurpassed scenic beauty, deep gorges, New River gorge near Babcock is 1,000 feet deep.
Cacapon (4,577 acres)	Winchester Virginia	Ridge of Cacapon Mountain to Prospect Rock. Fishing, hiking. Wilderness area and scenic splendor.
Lost River (3,760 acres)	Moorefield	Lost River flows underground, reappears on the other side of the mountain. Lee White Sulphur Springs, famous resort of the '90s, founded by "Light Horse" Harry Lee. Foot trails, horse trails. Picnicking. Cabins.
Monongahela National Forest	East-Central portion of State, near Virginia	A very beautiful forest with many points of interest and facilities for recreation. Among the camps and recreation areas of interest are: Blue Bend Forest Camp, Stuart Forest Camp, Alpena Gap, Bickle Knob, Smoke Hole Forest Camp, Horseshoe Forest Camp and others. All are areas of unusual appeal.

Name of Park or Recreation Area	*Location*	*Description and Comment*
Watoga (10,926 acres)	Marlinton	2,600 feet above sea level. Within the boundaries of the Monongahela National Forest. 12-acre lake with boating and fishing. Great variety of plant growth.

SUGGESTIONS FOR STUDY

Questions and Problems

1. When did California first set aside some of the "big tree" and scenic areas as centers to be preserved from destruction?
2. What was the Antiquities Act? When passed?
3. When was the National Park Service created? What is the function of this service?
4. What are some of the great national parks of America? Where are they located?
5. What is the relation of the U. S. Forest Service to recreation?
6. Why do more people visit national forests and national parks annually?
7. Why can more people visit recreation centers today than could do so fifty years ago?
8. Why are recreation facilities needed more today than ever before in our history?
9. What are some of the things that persons look for in a recreation area; that is, what are some of the things that attract visitors?
10. What are some of the outstanding advantages of the South as a recreation area? some of the disadvantages?
11. What can be done to improve the South as a recreation center? What can be done in your own state?
12. Should we be interested in improving the South as a recreation center? Why?
13. What are some of the occupations created through the development of recreation?

14. List five advantages that come to a state or section through tourist travel and vacationists. Can you think of disadvantages?
15. What is a state park? How is it managed?
16. Do you have a department or division of state parks in your State? When was it created?
17. What are some of the reasons for selecting a given area for a state park?
18. What are some of the facilities required in state parks?
19. How many state parks do you have in your State? Where are they located? What are the outstanding features of each?
20. What is the relation of forestry to recreation?

Selected References

Books

Rolfe, Mary A., *Our National Parks* (two books), Benj. H. Sanborn & Co., Chicago.

Bulletins

Secure bulletins from National Park Service, Washington, D. C.; U. S. Forest Service, Washington, D. C.; State Departments of Public Parks.

Suggested Activities

1. Make a list of the state parks in your state, giving as much information about each as can be secured.
2. Write a report on: *Recreation Areas in My State.*
3. Write to the Southern Regional Office, U. S. Forest Service, Atlanta, Georgia, and ask for information about the national forests in the South.
4. Write to the director of the department of state parks in the states you would like to visit and ask for information about recreation areas.
5. Write to the National Park Service, Washington, D. C., and ask for literature dealing with national parks.
6. Make each member of the class responsible for describing one or more of the recreational areas in the South.

UNIT III—FOREST INDUSTRIES

CHAPTER 7

LUMBERING AND RELATED INDUSTRIES

LUMBERING was the first industry developed in the New World. It is still one of the most important in our industrialized nation.

The first sawmill is said to have been operated by water power. It was established at Jamestown, in 1625. A few years later, about 1631, another mill was erected at Berwick, Maine. In the early days of our history, there were large trees wherever there were people; consequently, sawmilling became a part of the activities of early settlement. Sawmills, in colonial times, moved with the people. Now, however, they are confined to the forest regions and the lumber is transported to the consuming centers. The services of thousands of workers are required to move lumber from the mills to the cities and towns where most of it is used.

Lumbering, with the exception of agriculture, is our most widely distributed occupation. It is an important industry in thirty-eight states.

The United States is not only the most important lumber-producing country in the world, but our nation uses fifty per cent of all the sawn timber. In spite of the fact that concrete, steel, and brick are increasing in use as building materials, new uses are being discovered for wood each year and there is little possibility of the lumber-producing business becoming less important in the future.

Among the sixteen major manufacturing groups, lumbering ranks fourth in the number of establishments, fifth in the number of wage earners employed, and tenth in the value of commodities produced.

Logging and Lumbering.—Perhaps the most romantic of all forest practices is logging and lumbering.

Courtesy Southern Region U. S. Forest Service

LUMBER IS A MAJOR SOURCE OF INCOME IN THE SOUTH

From the great forests of the West, where gigantic machinery is required and where dangerous log rafts are driven down roaring, icy rivers, and from the South where pulpwood logs are loaded on trucks by hand, have come stories of skill and courage and adventure.

Logging and lumbering may be divided into several jobs, such as selection of trees, felling, bucking, removal of logs from the woods, sawing, and other operations. All these jobs are important if the lumbering

operation is to be carried on profitably and by the best method for forest conservation.

Selection of Trees.—The selection of proper trees, which is discussed in the chapter, *Marketing Timber*, is very important if good forest practices are carried out. By proper selection the forest is made to produce a perpetual supply of saw logs, lumber, and other products. The kind of trees removed from the forest will depend largely on the available market and the kind of wood needed for that market. On very large lumbering operations, all species of trees are usually removed and sawed. A market for the lumber is then located if arrangements have not already been made for its sale.

Felling.—There is an art in felling a tree. Some of the old-time loggers can drop a tree on a peg stuck in the ground. This is important, since it is usually necessary for a tree to fall in a certain direction in order to protect young growth or to facilitate its removal from the location. A number of power saws have been devised for use in felling trees, but none has proved as satisfactory as the method of felling by hand.

In felling, a tree is notched on the side in the direction in which it is to be thrown. This is usually done with an ax. The tree is then sawed on the opposite side of the trunk with the cut toward the notch. Sometimes wedges are driven into the cut made by the saw to keep it from pinching the saw and to cause the tree to topple in the desired direction. A tree is usually cut to throw it in the direction in which it is leaning or on the side where the heavy branches will tend to pull it in that direction. Care is usually taken to fell the tree so that the trunk will not hit on a stump or rock and shatter, damaging the tree trunk for lumber use.

Trimming.—After the tree is on the ground, limbs are removed from the portion suitable for lumber.

Care is taken to trim them closely so that no snags are left protruding from the logs.

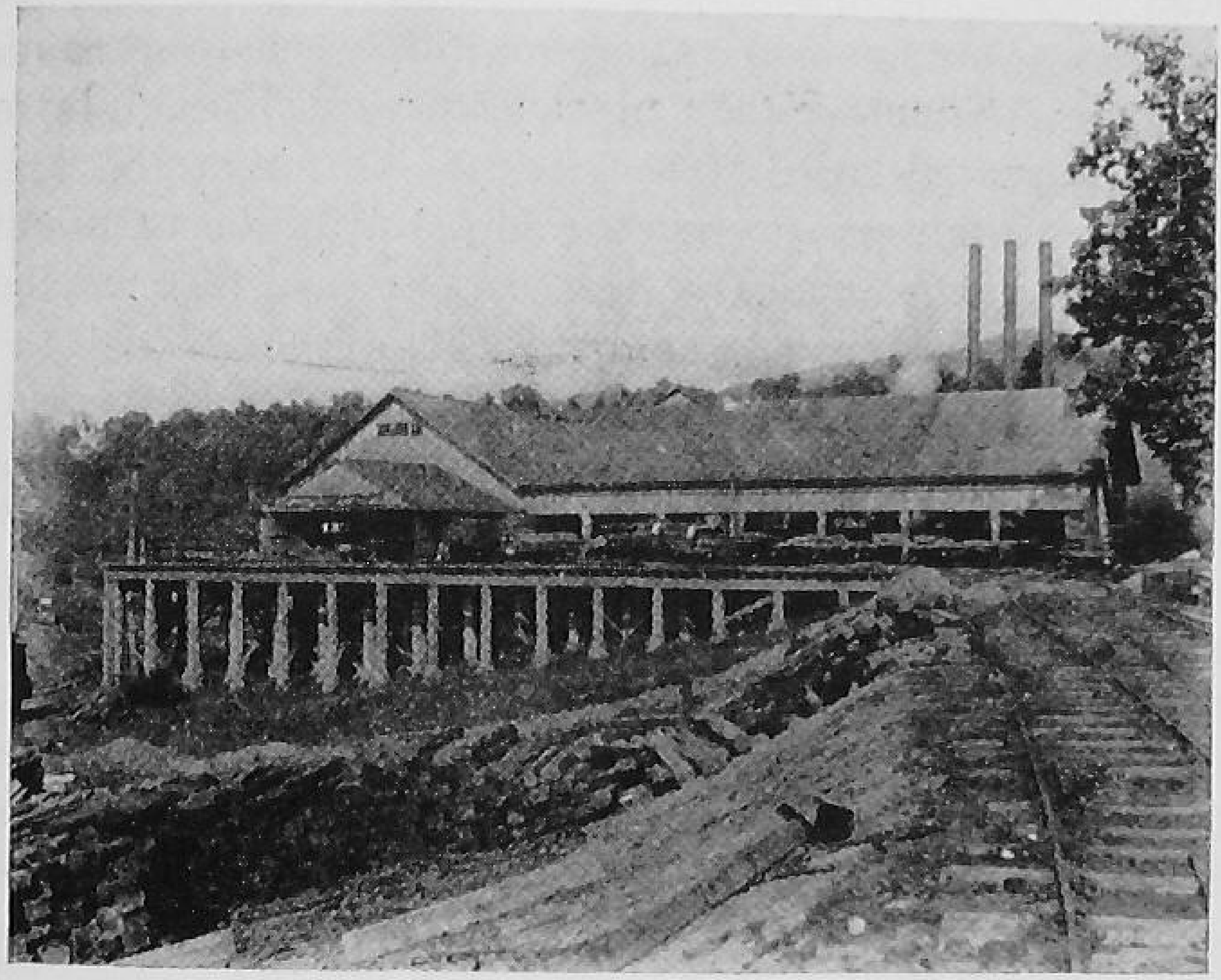
Bucking.—After the limbs are removed the tree is then ready for "bucking," which means cross-cutting the felled tree into logs. The lengths of the logs are usually from 8 to 20 or more feet. The "bucking" is usually done by two men with a crosscut saw. In the South the saw often collects a coat of resin which becomes so thick that the saw cannot be drawn through the log. This necessitates sprinkling the saw with kerosene to cut the resin off and make the saw easy to pull through the log.

Skidding.—Next comes the important job of skidding, or removing the logs from the woods to a loading place for transportation to the mill. Into the South have come log-skidding practices from all over the nation. The overhead, high line method of transporting logs out of the woods, is one which has been introduced into the cypress swamps that are too wet to support tractors, yarding sleds, and other heavy logging equipment. By this high-line system, a cable is strung between two tall trees, called spar trees. Pulleys, placed on the cables, are hauled back and forth by means of a donkey engine. Logs are sometimes pulled long distances from the woods by this method. With large operations this method is practical, especially for moving big timber.

Tractors are often used in removing logs from the woods. They are used in many instances in connection with yarding arches. The yarding arches lift one end of a log from the ground. The tractor is then hitched to this equipment and the log is towed out of the woods. The yarding arches or sleds may be pulled by tractors, horses, mules, or oxen. This method of bringing logs

out of woods is used in the South where topography permits.

Hauling Logs.—Logs are transported in many different ways. A log may be transported by several methods before it reaches its destination. In the North



A Sawmill in a National Forest

Lumber companies operating in a National Forest cut only such timber as is marked for harvesting. In this way a sustained yield policy is made possible

they are transported on sleds over ice. Chutes down mountain sides are sometimes used. Wagons pulled by horses, mules, or oxen are still in use. The use of motor trucks is today the most common method of hauling logs in the South. In some sections of the country logs are floated to the mills in streams of water. Pulpwood is sometimes transported in the South by barges.

Sawing at Large Mills.—At large mills the logs are dumped into ponds. This bath washes them free of sand, small rocks, and other foreign elements which would tend to damage the saw. It also keeps destructive insects from breeding in the logs, and prevents the timber from drying and cracking or checking.

The logs are pulled out of the mill pond by a chain conveyor. They are then placed on a carriage and are ready to saw. This carriage is run past the saw with enough of the log left over the edge to produce a plank or board of the width desired. The saw may be either of two types, *band* or *circular*. On large operations the band saw with teeth on both sides of the blade is used. The log is sawed on its trip forward and back, which almost doubles the speed and production of the mill. Sometimes gang saws, of several mounted saws are used. In this manner, several boards may be sawed from the log at one time.

While they are being sawed, the logs are turned on the carriage in such a way that the maximum amount of clear lumber is produced. The cut lumber is then placed on conveyors, and run through an edger or trimming saw, which cuts away the rough ends and edges from the boards. Slabs and edgings are usually sent to the boiler room and used for fuel. Using refuse as fuel reduces the cost of operations.

After the lumber is cut it may be seasoned by stacking in the open with the layer of boards separated by narrow strips of wood so that air may circulate between and around each piece. In a hot dry climate, sometimes only about three months is required for seasoning. If conditions are not right, seasoning requires a much longer time. Kiln drying is another method used in seasoning. This hastens the seasoning process and makes the lumber ready for the market in much less

time than it would be if put through a process of seasoning in the open air.

Portable Sawmills.—Portable sawmills cut a large per cent of the lumber produced in the South. In one recent year, for example, there were more than 10,000 portable mills in operation. These mills locate in a timbered area or section and move from place to place

Courtesy Southern Region U. S. Forest Service

UNLOADING LOGS FROM TRUCK TO TRAIN

within the area to avoid long hauls of the logs. Small gasoline engines, tractors, and even trucks furnish power for such mills.

Lumber Production.—The ouput of lumber in the South during one recent year was valued at almost six hundred million dollars. Lumber is, of course, raw material for a variety of industries. The total value of lumber and the products produced from it in the South in one recent year was $1,335,222,000. This production made possible the employment of about 300,000 workers who earned $356,000,000 in wages. It also provided employment for others who earned more than $83,000,000 in salaries.

Lumber and Timber Products

State	*No. of Mills*	*No. of Workers*	*Value of Products*
Alabama	1,579	35,420	$158,161,000
Arkansas	1,019	28,210	128,226,000
Florida	797	12,006	54,627,000
Georgia	1,901	31,120	141,596,000
Kentucky	687	9,616	43,752,000
Louisiana	882	24,912	112,555,000
Maryland	303	3,326	15,133,000
Mississippi	1,538	29,772	135,462,000
Missouri	569	5,855	29,453,000
North Carolina	1,884	25,833	117,531,000
Oklahoma	116	1,821	8,285,000
South Carolina	1,001	18,204	82,828,000
Tennessee	1,117	14,309	65,105,000
Texas	1,017	26,296	119,646,000
Virginia	1,657	18,264	83,101,000
TOTALS	16,067	284,934	$1,295,231,000

Within a 10-year period there has been a gain of approximately 30 per cent in the lumber and timber operations of the 15 states listed

Dressed and Mill Worked Lumber.—After the lumber is kiln dried, it is not completely finished. One of the most important steps in the manufacture of lumber is planing and working it into the various necessary products. Sometimes the planer produces stock boards, sometimes it turns out flooring, siding, moulding, framing, or even paneling. It comes out of the planer as dressed lumber and is ready for shipment to all parts of the world. Most of the lumber is marketed to consumers as finished or dressed lumber or as mill made doors, windows, and other products.

Veneer.—The lumber trade has many related industries. An important one to the South is veneer wood, used in making such products as cigar boxes, orange crates, and many other types of wooden containers. Valuable wood is also cut as veneer and used over the top of inferior wood in furniture making.

Veneer making is no new industry. It is said to date

back to the earliest days of civilization and was important in the early history of Egypt.

The manufacture of veneer is an unusual and interesting procedure. Huge logs are cut into four-foot lengths and brought in to the mill, usually by truck. There may be pine or poplar for boxes or crates, walnut or oak for furniture. The huge sections of logs are thrown into a vat of boiling water and steamed until all the wood cells are soft. They are then brought up by a chain conveyor and placed in rotary pivots. The log revolves against a sharp knife and the veneer or plywood is peeled off in a thin, continuous layer. This layer is cut into the desired lengths and either air or kiln dried.

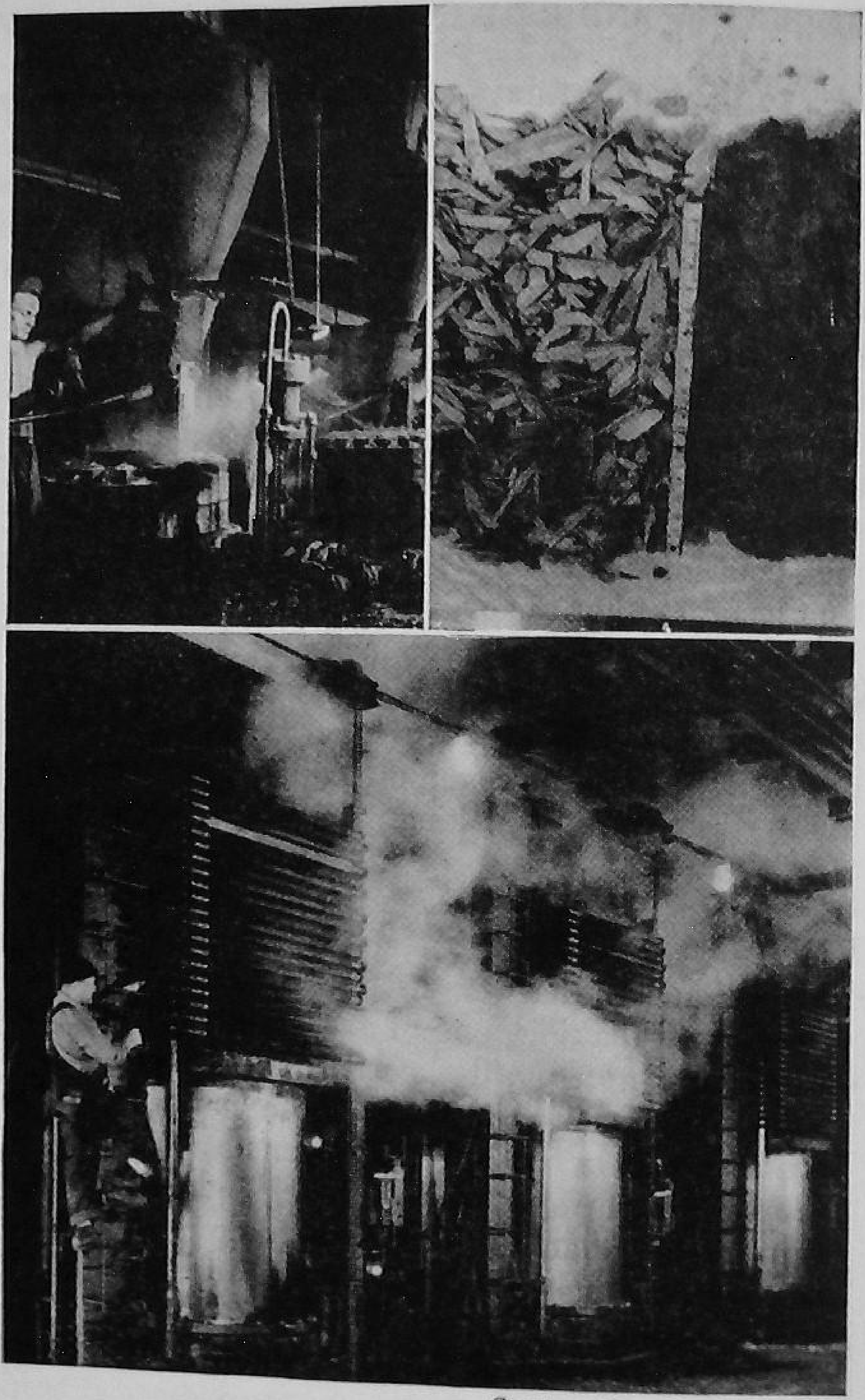
The remaining core, four inches in diameter, is used either for making excelsior or for pulpwood.

Furniture Making.—Another industry which has grown rapidly in the South during the past quarter of a century is furniture making. In one recent year more than $771,000,000 worth of furniture was made in southern plants. This amount represented almost a fourth of the value of all furniture produced in the United States in that year.

Furniture making, one of the oldest industries, was considered a craft until almost 1900. Close to the turn of the century, furniture became a machine product. Today very little furniture is handmade.

Some furniture is made of steel, glass, and other products, but that made of high-grade wood, such as black walnut, quarter-sawed oak, and cherry is still in greatest demand.

Patented Products.—The march of time has brought many new products into the industrial world. Many such products are made of wood, and the time is not far distant when the number of such wood products may be multiplied many times.



Courtesy Masonite Corporation

"Wood Shot from Guns"

In the plant of the Masonite Corporation, Laurel, Mississippi, wood is transformed into many patented products.

One of the most important of the new wood-using industries, for example, is that of the Masonite Corporation located at Laurel, Mississippi. Here, by what is known as the explosion method, wood is "blown" into fibers and reconstructed into products sold in every state in the nation and in thirty foreign countries.

Among the many unique products made at the Masonite plant we find structural insulation, quarter-board, prestwood, temprtile, cushioned flooring, and acoustical tile. Of course, some of these words are *trade names*, but we understand what they mean. For example, *temprtile* is an "imitation" of the tile made from clays. It is used for floors and walls in bathrooms, kitchens, and pantries. Acoustical tile is used on ceilings and walls to absorb sound. All are important articles of commerce, typical of the progressive age in which we live.

SUGGESTIONS FOR STUDY

Questions and Problems

1. When and where were the first sawmills established in this country? In how many states is lumbering an important industry? What part of all sawn timber is used in this country?
2. What are some of the important jobs in logging and lumbering?
3. What largely determines the trees to be selected for sawing?
4. Tell of the steps in felling a tree.
5. What is meant by the following terms: trimming, bucking, skidding? What are some of the methods used in skidding?
6. Give some of the methods used in hauling logs to the mill. What method is most commonly used in the South?
7. Tell how sawing is done at a large mill. How is the lumber stacked after it is sawed?

8. What is the common method used in seasoning lumber? How many portable sawmills are there in the South?
9. How does the South rank among the regions of the nation in lumber production? How does your state rank in the South?
10. Before most lumber is placed on the market, how is it finished?
11. What is veneer? Tell how it is made. For what is it used? What is the approximate annual value of the furniture made in the South?
12. What are some of the kinds of wood used in making furniture?
13. Where are the two Masonite products plants located? Tell briefly of the process used in making these products. What is temprtile and for what is it used? Name some of the Masonite products and their uses.

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Other References

Blue Book of Southern Progress, published annually by the Manufacturers Record Publishing Co., Baltimore, Md.

Agricultural Statistics (Published annually), U. S. Department of Agriculture, Washington, D. C.

Suggested Activities

1. Carry class to nearby sawmill and observe the following: (1) Power by which mill is operated. (2) Number of

people employed. (3) Whether circular or band saw is used. (4) The board feet capacity of mill per day.

2. Carry class to plant where doors, windows, and moulding, and such like are made. Secure from operator a list of articles made for market.
3. Visit nearby logging operation. Record (1) kinds of trees being cut, (2) methods used in felling, (3) means of transporting logs to mill.
4. What is the value of the lumber and timber products produced in your state, as given in the table found in this chapter? What is the total value of the lumber and timber products produced in the states listed in the table?
5. Make a list of all the different kinds of wood used in the furniture in your home.

CHAPTER 8

AMERICA'S PAPER INDUSTRY

PAPER is one of the most essential articles in the daily life of the American people. Each year every citizen of this country "consumes" 226 pounds of paper. We use more pounds of paper than we do meat. In fact, the average citizen of the United States uses more paper than any other material, with the exception of milk and water.

Each morning most of us turn to the newspaper to discover what has happened the day before in all parts of the world. Millions of school children spend most of their time reading from paper. Our household supplies are wrapped in it. Paper is everywhere.

Paper making, in point of value, ranks fifth among American industries.

Each year we use enough "news print" paper to reach to the moon and back seventy-five times.

Several hundred thousand American citizens are employed in paper making and related industries.

To fully understand how important paper is to all of us, try and realize what one day would be like if we had no paper. How would your life be affected? What are some of the occupations that could not be carried on without paper? How would the civilization of the world have been changed without paper as a medium for transmitting the ideas and experiences of mankind?

Paper in the Ancient World.—There was a time

in the history of the world when there was no paper, but that was very long ago.

It is said that paper was invented in China more than two thousand years ago. The story is most interesting!

It seems that there was a very wise Chinaman by the name of Ts'ai Lun. He taught his people how to grow crops and how to care for their soil. Each day great numbers of his fellow countrymen came to him for helpful advice.

One day the Emperor called Ts'ai Lun and said to him, "You cannot live always. What will the people do after your death? How can your wisdom be preserved? Can you not find some way to pass on your great knowledge to those who are to come after you?"

Ts'ai Lun gave serious thought to the problem. The result was that he invented paper on which to write down his thoughts and observations.

In recognition of this achievement, he was made a noble by the Emperor.

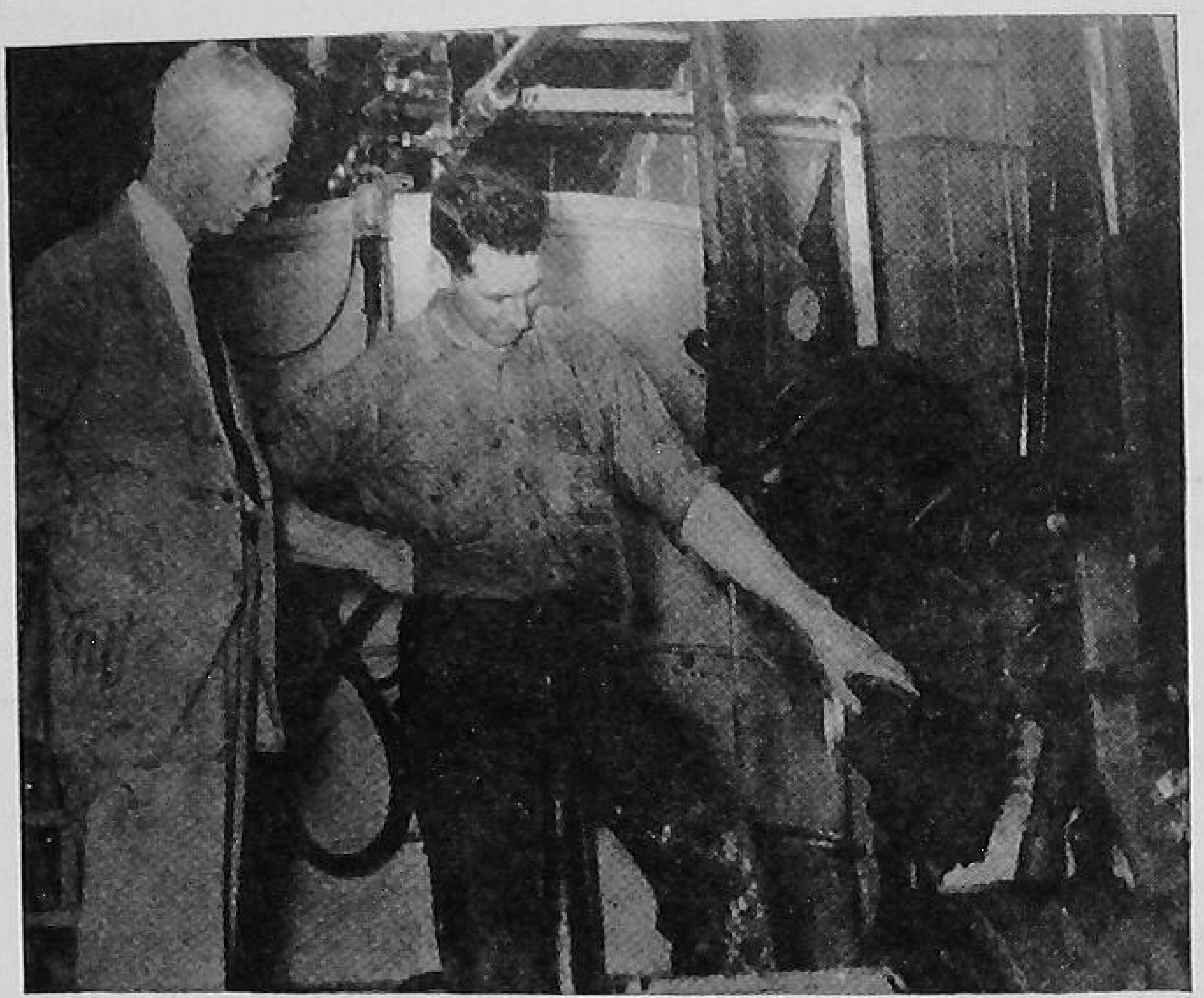
Just how paper was made in China two thousand years ago is not known. But, of course, it was by a very crude process; even more primitive than the very inefficient methods that are still in vogue in China today.

For centuries the methods of making paper used in China were kept secret. Only those engaged in the work had any idea what processes were used. Many invading armies sought to secure information about these secrets, but for hundreds of years Ts'ai Lun and those workers who succeeded him passed these secret processes on from generation to generation by word of mouth.

But other countries also learned how to make materials which served for paper.

In ancient Egypt a plant was grown known as *papyrus*. It is from the name of this plant that we get the word paper.

Papyrus was a very useful plant. Its stems were bound together to make boats. Its fiber was woven into cloth. The bark was used for sandals and dishes. It was used to make boxes and other containers. Young plants were used for food and a drink was manu-



Courtesy The March of Time

DR. CHARLES H. HERTY

Dr. Charles H. Herty, noted chemist, demonstrated in his Pulp and Paper Laboratory, Savannah, that southern pine makes excellent paper. His research contributed to the development of forest industries in the South

factured from papyrus. In fact, the plant had dozens of practical uses in Egyptian life.

The pith from the papyrus was used to make a paper-like material.

So valuable was this writing material in the minds of the rulers in many countries that wars were fought in an effort to get possession of the plant. But, as a matter of

fact, it was a poor substitute for paper. At first the sheets of papyrus were a light yellow. With age, they turned to a darker shade of yellow or tan. They were somewhat fragile but it was the best material then available, and, consequently, is of historical interest.

The present billion dollar paper industry of America owes its modern development to a lowly insect—the wasp.

It was the wasp which taught men to make paper from wood.

While men had watched the operations of wasps for many centuries, it was not until quite recently that a German scientist by the name of Fredrick Keller first produced a successful machine for grinding wood into pulp.

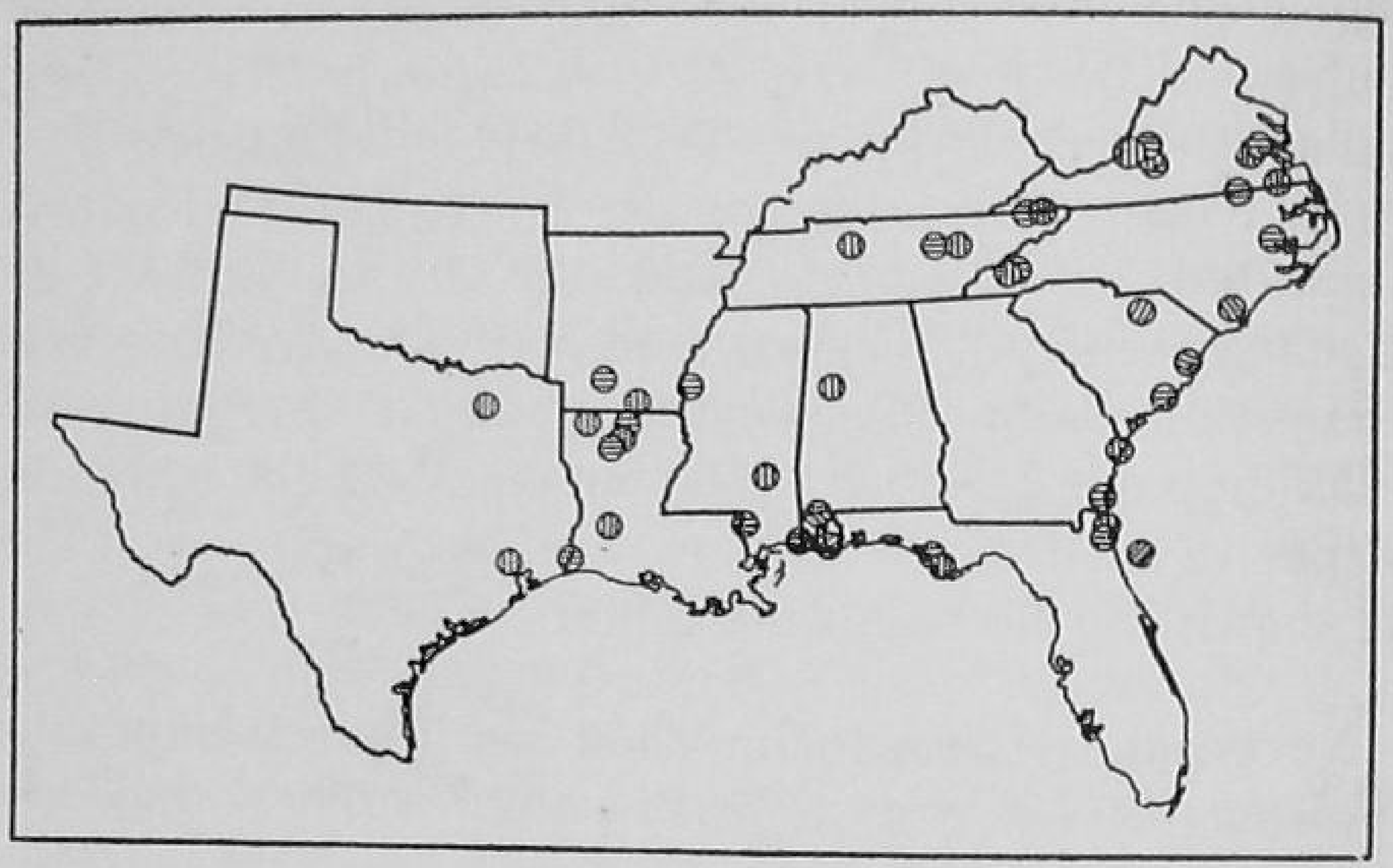
Did you ever watch a wasp make paper?

First, she tears off a small piece of wood, such as a sliver from a fence rail. Then she chews it into pulp, moistens the pulp and works it into a paste which she spreads out to dry. In the course of time she completes a cone-shaped nest of real wood-pulp paper. Then she makes paper bands which are used to fasten the nest to a tree, or some other safe and satisfactory place for a home.

Practically all of our paper is now made from wood. But paper may be made from many substances. In China, today, paper is made from rice straw. It also is made from bamboo. In fact, paper can be made from any substance which produces *cellulose.* This is the same substance as cotton fiber. Paper is made from cotton to a limited extent. And, on the other hand, articles of clothing, curtains, and other cloth may be made from wood. It is possible that trees may become the source of much of our cloth in the future.

For a long time paper was made chiefly from rags.

In the generation when your father and mother were young there were men who went about the country buying all the old rags they could get. As more and more books and papers were printed, it became exceedingly difficult to get enough rags to make paper. Many amusing things have been said about the rag-buyers and rag-



THE SOUTH'S FIRST PAPER MILLS

pickers. Some person wrote the following poem, which suggests the vigorous search for rags conducted by the growing paper industry:

> Sweet ladies, pray be not offended,
>   Nor mind the jest of sneering wags;
> No harm, believe us, is intended
>   When humbly we request your rags.

The lesson of paper making as demonstrated by the wasp and developed through applied science has solved the problem of the paper maker, however, and we now look to the forests of the world for the raw material out of which to make the immense amount of paper we require.

America's Paper Industry.—The United States consumes more paper than all the remainder of the world combined. Of the 24,000,000 tons made in one year in the entire world, about 15,000,000 tons are used in this country.

Our paper industry first developed in New England, along with other manufacturing. As the years went by, pulpwood became scarce in that section. Hence it was difficult to supply the needs of their mills for pulp.

In recent years much of the wood required has been imported from other countries. It has come from Canada, Finland, Sweden, and Norway. We have been importing about fifty per cent of the wood required for making paper, and yet we do not make enough newsprint paper in the United States to meet our own needs. This is shown by the following table:

World Paper Production and Consumption
Showing the Per Cent Produced and Consumed in United States

Kind of Paper	*Production*	*Consumption*
Paperboard	45%	37%
Newsprint	8	25
Wrapping	15	12
Book	12	9
Fine papers	5	4

It will be observed from this table that we are making more of all types of paper than we consume, with the exception of newsprint. This is the paper from which newspapers are made. We make only 8 per cent of this class of paper, and yet we consume one-fourth of all the newsprint of the world. This is the type of paper making in which there is the greatest national interest.

With the scarcity of wood for paper making, it was quite natural for the manufacturers to turn to that part

of the country with a large forest area. This was the South.

For many years it was thought that the southern pine was not fit for paper making, the reason being that there was so much pitch in the wood.

That problem was attacked in the laboratories, however and it was demonstrated that the southern pine was admirably adapted to the making of paper.

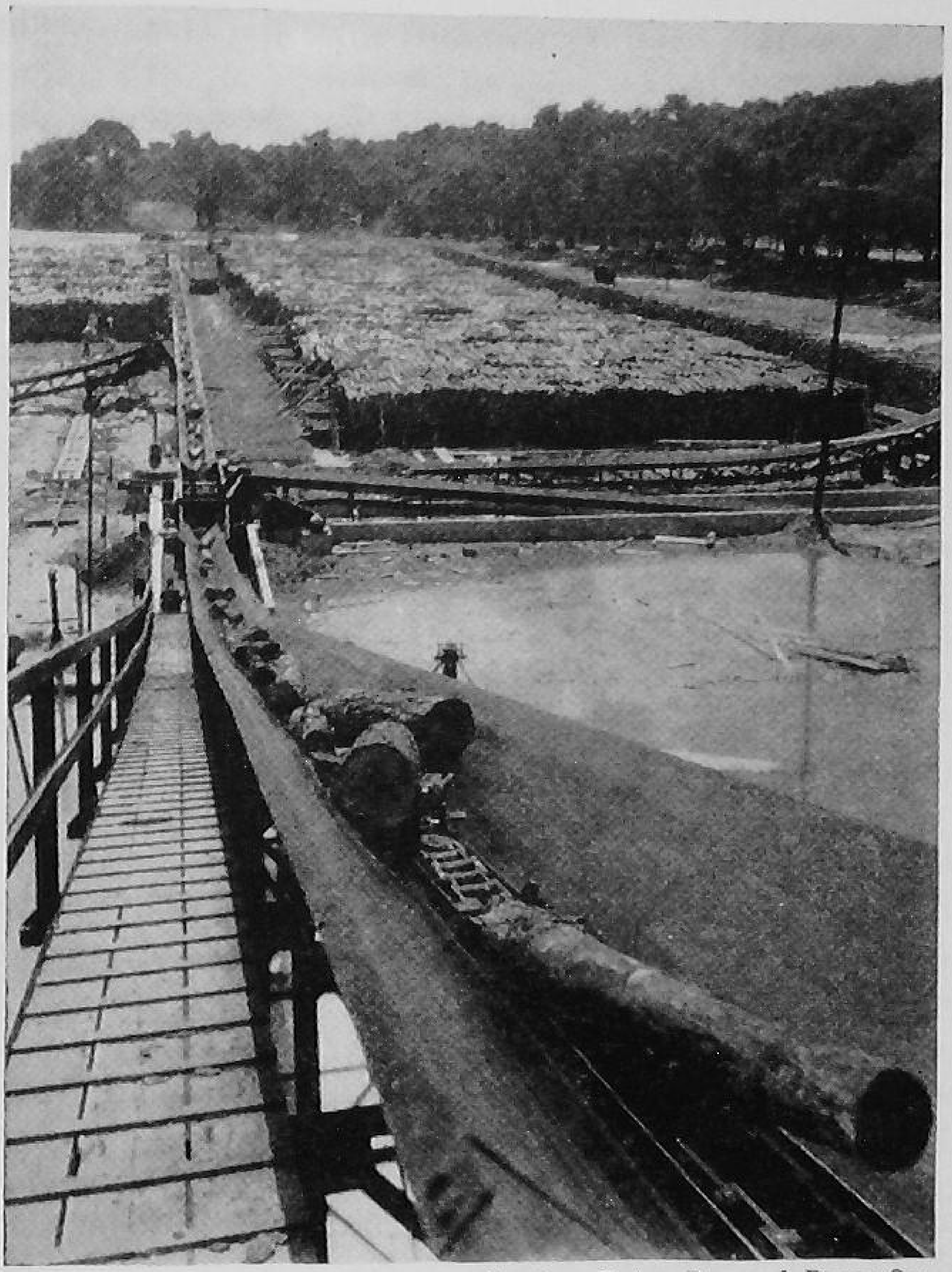
The adaptability of the southern pine for paper making was demonstrated by Dr. Charles H. Herty in his laboratory at Savannah, Georgia. The Forest Products Laboratory at the University of Wisconsin also proved conclusively that paper could be made from southern pine.

There have been small paper mills in the South for many years. Since 1935, the movement of paper mills to the South has been very rapid. In fact, in recent years new paper mills have been built in no other part of the world. Most of the southern mills are devoted to the making of what is called kraft paper. This is the brown type of paper used for making paper bags and wrapping.

Dr. Herty demonstrated that white papers of all types, including newsprint and book paper may be made from the southern pine.

It is believed that the South will soon occupy the same position of leadership in paper making that it does today in the textile industry.

The Future of the Paper Industry.—The United States Department of Commerce in sponsoring a series of nation-wide broadcasts dealing with American industry, included *The Story of Paper* which contained the following interesting comment concerning the future of the industry, especially as it relates to the making of paper in the South:



Courtesy Union Bag and Paper Cor.

A PULPWOOD CONVEYOR

Into the great paper mills of the South a continuous stream of logs is conveyed—day and night. In these plants huge pine trees are converted into paper which is shipped to all parts of the nation and to foreign countries

"We really live in a paper world. Paper is used in building our houses and our automobiles. Countless lives have been saved through the use of sanitary paper cups and towels, the paper wrapping of food, and paper surgical dressings.

"Perhaps the checkbook which you carry is protected by the use of secret chemicals in the paper which will instantly flash a warning streak of color in case anyone tries to tamper with your writing on a check. Nowadays, there are books published for the blind, thanks to a special paper on which the letters are raised so that they may be followed with the fingers. Paper handkerchiefs help to prevent the spread of bad colds. And one of the latest developments is so marvelous as to be difficult to believe—flameproof paper can now be made. Some of this flameproof paper, which will not burst into flames, is used for the decoration of ballrooms or Christmas trees. The flame-proofing process can be applied to any kind of paper.

"The paper industry clearly shows how modern science and machinery have created work for thousands of men. For example, it is said that one man with modern machinery can make 10,000 times as much paper in a day as did the inventors of paper making in China, long ago. And yet today there are over 125,000 men directly employed in the paper mills of America. This figure does not include thousands more who are given work in the distribution of paper products, or who bring the raw materials from the forests to the mills.

"And here is a fact that will interest everyone who loves the woods and the great outdoors. The paper industry today is taking a vital interest in forest conservation. Under scientific forest management as it is being practiced more and more in the United States today, much of the pulpwood comes from the thinning out of

the smaller trees that would otherwise be choked out and die. Some of our pulpwood comes from the tops of trees left on the ground by the loggers, and some of it comes from a type of tree which, having matured, would soon decay anyway.

"And here is some encouraging news for the future. A nation-wide survey already partially completed by the United States Forest Service shows that our present

Pulpwood Ready for Shipment

With the many paper mills now in operation in the southern states, every farm should think of pulpwood as a new source of income

forest area could, under scientific forest management, be made to supply all of our pulpwood requirements indefinitely.

"And here is more news, of particular interest to the South. I am told that the announcement has been made of plans to build the first newsprint paper mill in the State of Texas. For it has been found that newsprint can be made from the southern pine, as well as from

the spruce and hemlock of our northern and western forests.

"Already, large quantities of kraft or wrapping paper are being made in the South—a new industry from the forests of Dixie.

"People are reading more and more books, periodicals, and newspapers. One novel, *Gone with the Wind*, has made necessary the use of 1,500 tons of book paper. Day and night the giant paper mills are spinning. The manufacture of paper has become one of our giant industries, but we cannot measure its worth in physical, economic, or financial terms. With its help, civilization marches on. Science, literature, art, knowledge—all the finer things of life—owe most of their advancement to paper."

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are some of the important uses of paper?
2. How much paper is used per capita in the United States?
3. What per cent of the paper of the world do we use?
4. Do we make all the paper we use?
5. What kinds of papers do we import?
6. Of what is paper made?
7. When was paper invented?
8. Where did the name paper come from?
9. From what materials is paper made?
10. What is meant by wood pulpwood? Do we produce all we use?
11. In what part of the country has most of our paper been made?
12. Why are paper mills coming to the South?
13. In what southern states are paper mills located?

14. What kinds of paper are made in the South?
15. Into what groups is paper classified?
16. What was the first objection to using southern pine for paper?
17. What southern chemist proved that excellent paper might be made from southern pine? Where did he do his work?
18. What insect helped demonstrate how paper is made?
19. Who first invented the pulpwood method of making paper?
20. What are some of the ways in which the South benefits from the papermaking industry?

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Southern Forestry Experiment Station (New Orleans)—Paper Making in the South and the Supply of Pulpwood.

Wood Utilization Laboratory (Madison, Wisconsin)—Making Paper from Pine.

American Paper Company (Holyoke, Mass.)—How Fine Paper Is Made.

Suggested Activities

1. Make a list of all the uses of paper that are given in this chapter and then add all the others that occur to you.
2. After reading this chapter and the other two dealing with paper making and pulpwood write an essay on the subject: *Paper making and Forestry in the South.*
3. Write to the U. S. Forest Service, Southern Region, Atlanta, or the Southern Forestry Experiment Station, New Orleans, and secure information about the number of paper mills in the South.

Chapter 9

HOW PAPER IS MADE

PERHAPS one of the most famous of all old Southern colonial homes was the Hermitage, near Savannah, Georgia. There, in a magnificent grove of live oaks, moss-draped and ancient, Oglethorpe and the first Georgians landed to carve a new empire out of the wilderness. The first, tiny settlement with its handful of men seemed utterly incapable of coping with the vast, uncompromising world that lay up and beyond the river. But that settlement near Yamacraw Bluffs, was the nucleus of an empire.

It seemed fitting that the Hermitage plantation, one of those spots which cradled a new civilization, should be the scene of the famous motion picture, "The Birth of a Nation."

Today the house, with its slave quarters, its beautiful gardens, its ancient trees, is gone. But from it every stone and historic piece of wood, have gone into the building of Henry Ford's home on the Georgia coast.

Today, on the site where Oglethorpe landed, where the Hermitage gathered dignity with the years, stands the symbol of the beginning of a new era in the South. Out of the earth, silhouetted in gigantic proportions against the marsh and the river, has grown a paper mill. Smoke from its massive stacks gives some indication of the romantic story inside, where thundering machinery, huge tanks, almost unbelievable in size, vats of aromatic

liquids, clacking chain conveyors, and cyclone tanks are each day transforming thousands of pine trees into tons of brown paper.

From Logs to Paper

From each point of the compass come the logs; by rail, by truck, and by barge. They are stacked, thousands of cords of pine wood from four to twelve inches in diameter and five feet long, in enormous piles in the wood yard, to await the moment when they will be thrown into a conveyor and started through a process of paper-making, from whence they will finally end in someone's home as a paper bag, filled with groceries, or as a piece of brown wrapping paper from some mercantile establishment.

Once it has been thrown on the *chain conveyor* and begins its journey into the plant, the life of the log itself is short. It is dropped into a huge revolving iron cylinder made of steel bars and spaced far enough apart so the bark will drop through. This cylinder is known as a *barking drum.* In it the bark is fairly blasted from the white sap wood. This bark is not wasted. It is carried by another conveyor to feed a large boiler, from whence steam is supplied to turn the powerful *turbines* and make electricity needed in the plant. Some of this steam is also used in the processes of cooking and washing the pulp.

The Work of the Chipper

The peeled logs are carried mechanically to a rotary, bladed giant known as the *chipper.* This roaring, razor-toothed monster grinds a large pulp log into bits within a few seconds. It has an enormous appetite, consuming as many as sixty cords of pulpwood each day. It never wavers, never changes pace; its hungry roar is never

softened, regardless of the thousands of pulpwood logs poured into its gaping mouth.

The first breaking down process of the pulpwood log is completed and the chips appear, some large, some small, and all mixed with splinters, wood knots and pieces of small wood which in some miraculous manner, avoided the roaring blades of the chipper. All of this wood is carried to an *elevator* and lifted to the top of *shaker screens*, which allow chips that are from 5/8 to 3/4 of an inch long and 1/4 to 3/8 of an inch thick to pass through. The pieces of wood and the chips too large to pass through the screens are carried by a belt to the *crusher*, reduced to proper size and sent to the *chip bin*, over the *digester tank*, where they again meet the chips which passed through the screens. Those screened chips are exactly the correct size, for after they were screened to remove the larger wood and knots, they were screened a second time to take out the smaller particles, as sawdust and tiny bits of wood. This surplus material is also sent to the boiler room and converted into fuel.

The remaining chips, just right in size, are sent through the plant on a long conveyor to the chip bin, located above the digester tanks. In the chip bin they are stored until ready for use.

The Cooking Tanks

Up to this point, the chips have been hard, brittle pieces of wood that would burn in anyone's stove, but the next step is to remove the hard binding and make them into soft, pliable fibres, ready to convert into paper. The *digester tanks*, or cooking tanks, are constructed from heavy steel. Thirteen of them, several stories in height, wait to be fed. Each one of those digesters will hold 7½ tons of wood chips.

The tanks are filled and *cooking liquor* from the

All the pictures reproduced in this chapter were taken at the Fernandina, Florida, plant of the *Container Corporation of America*. There are 10 pictures in the series, each showing the successive steps in the making of kraft paper from southern pine trees

measuring tank is turned into them. A heavy steel cap is clicked into place and steam from the boilers turned in. This steam is circulated again and again through the heater and the chips are cooked until all the hard, woody structure of the chips is broken down. This process requires several hours.

After the cooking process has been completed, the valve at the bottom of the digester is opened. The pressure of the steam in the digester blows the entire mass into a huge tank, shaped at the bottom like a cone. This tank, known as the *cyclone tank*, separates the steam from the pulp. The steam is shot into a *condenser*, and turned again into hot water and stored for the process of washing the pulp.

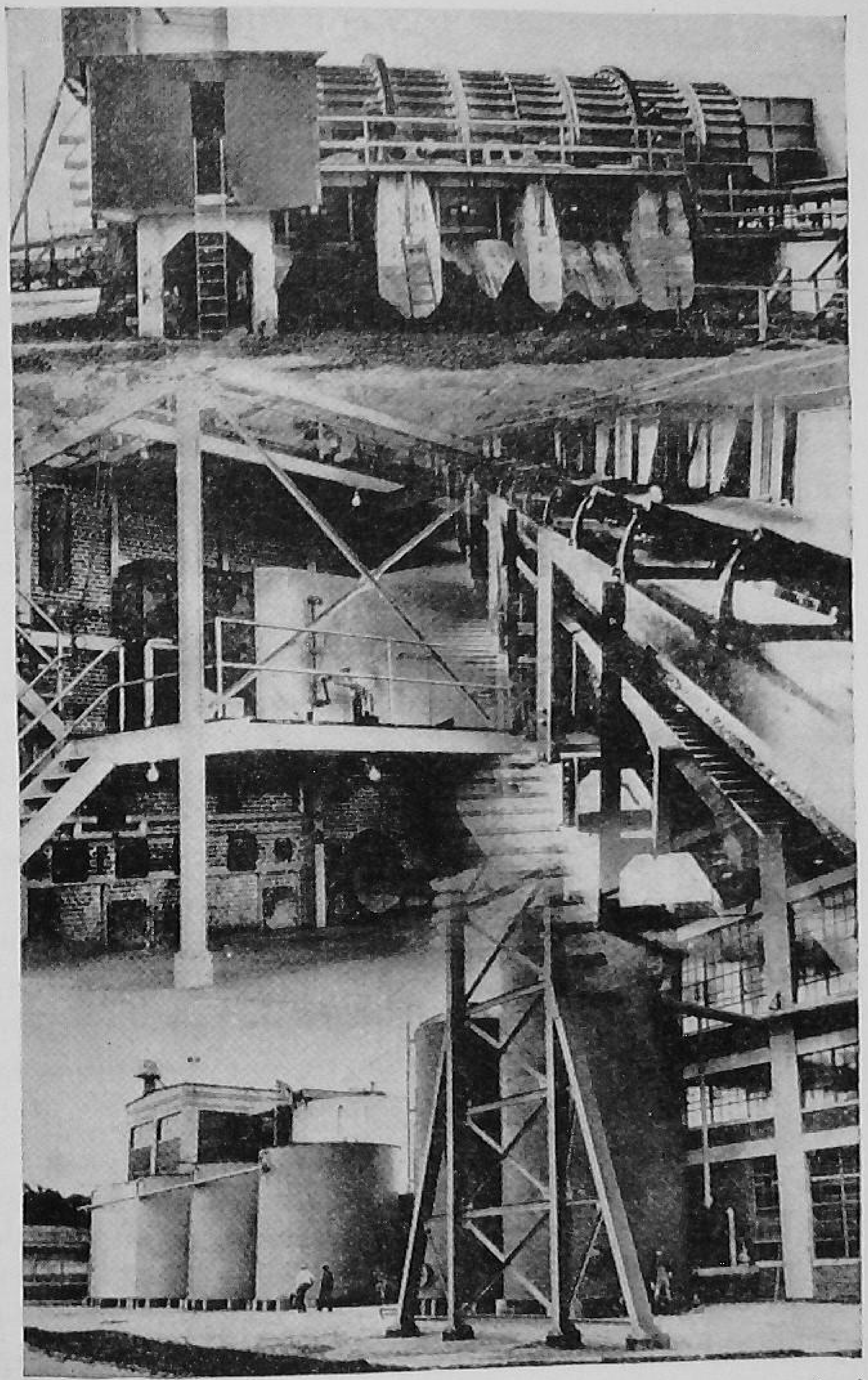
The pulp itself filters out of the cyclone tank and back into the *diffuser tanks*, where the cooking liquor is drained off to be brought back to its original strength and used again.

Logs Become Pulp

The pulp is washed and rewashed and as long as the washing water tests strongly of the cooking liquor, it is saved and sent back to the *black liquor* or weak cooking liquor tank to be sent through the process of rebuilding it with chemicals to the proper strength.

After the pulp has been washed thoroughly, it is drained into a huge concrete tank and stored until it is ready to begin its final journey through the paper mill.

The washed pulp is then put through another series of screens. There it comes into sight again for the first time since it has entered the digester tanks from the chip bin. It has been converted into a brown, liquid mass, which looks like muddy water. The pulp screens remove all knots and uncooked wood which are salvaged and returned through the mill for a second trial.



Top: The second step in the making of paper is the removal of the bark. *Middle Right:* After the bark is removed, the logs are cut into chips. *Middle Left:* Huge boilers reduce the chips to a mass of pulp. *Lower:* These huge chemical storage tanks are the source of fluids used in producing kraft pulp.

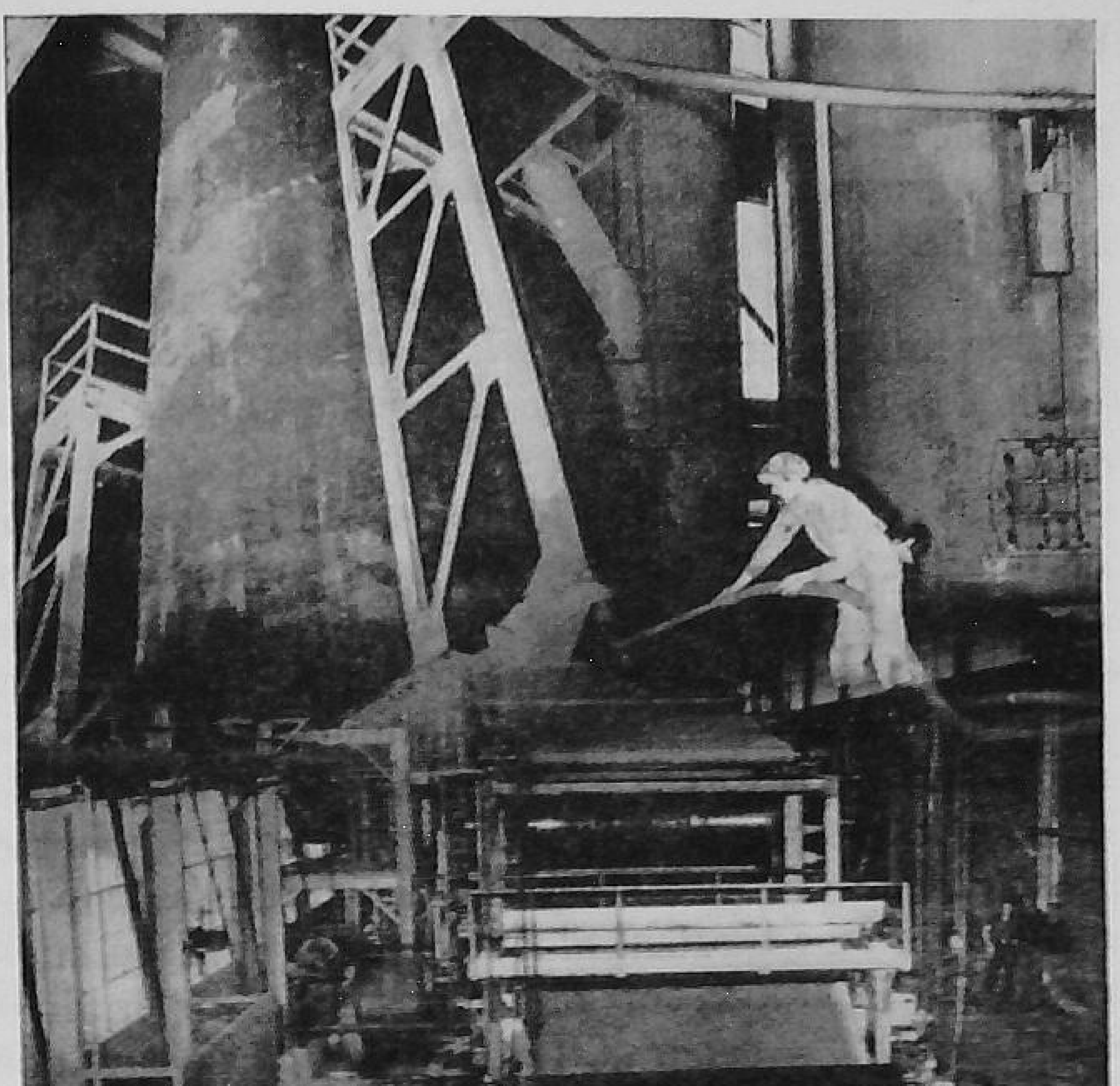
From the screen, the pulp goes through a thickening process and much of the water is removed. The brown heavy liquid is then pumped into heavy rotary grinders or refining engines, known as *Jordans*. There the thin fibres are given depth and thickness, making them fluffy and pliable. After the pulp has been refined in two sets of the Jordans, it is pumped into another large tank, where *rosin size* and *alum* are added as water proofing and the raw paper stock (pulp) is pumped to the head of the paper making machines.

From Pulp to Paper

Before it begins the final stage of its journey the pulp is diluted in the ratio of one pound of fibre to 50 or 60 gallons of water. This liquid mass is turned on to a rotary wire screen 90 feet long and 234 inches wide, known as the *Fourdrinier part*, after its inventor. This machine removes much of the water by gravity and at the end of the rotary wire screen, the first semblance of paper appears, a watery sheet. This sheet, unable to support itself over the four feet length between the wire screen and the *couch* must be carried on a woolen felt. This couch, which is the first press, is made of rubber and the bottom roll has a suction process for drawing water from the sheet of pulp, as have the next series of *presses*.

From the presses the rapidly forming paper passes to the *drying rolls* which are huge steel cylinders filled with steam from the boilers. The paper enters the dryers at approximately 70% moisture and leaves them with less than 6% moisture.

The layer of pulp that enters into the first presses is transformed into unglazed, brown wrapping paper. If a smooth finish is desired, the last operation is to run the brown paper through a *stack of calenders*, or 8 steel



Upper Left: These two digesters hold 12 tons of kraft pulp. *Upper Right:* Diffuser tanks take the pulp from the digesters. *Center:* Here the pulp is passing through rollers which squeeze it to paper thickness. *Lower:* Here the pulp is shown passing through the thickener

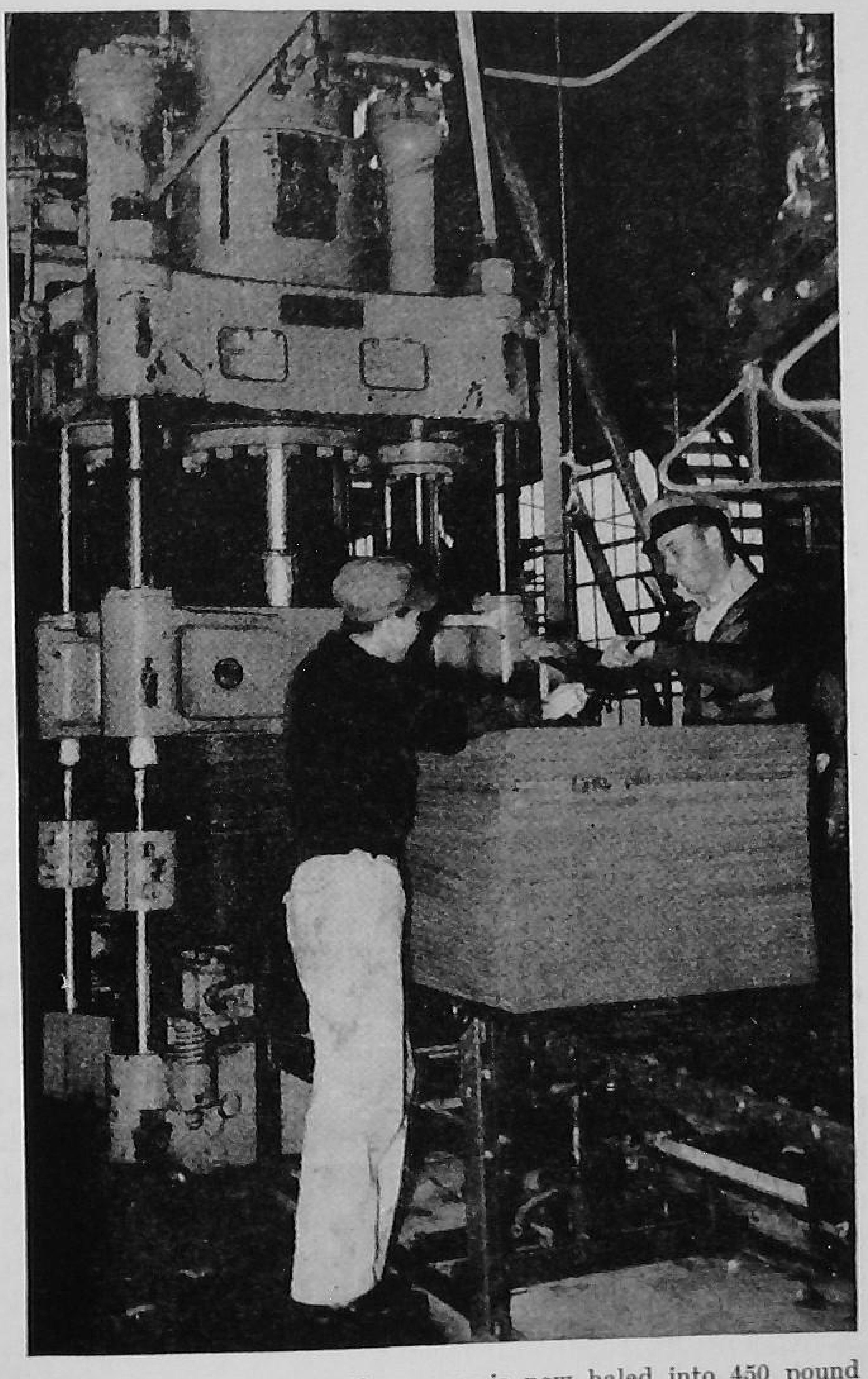
rolls, one on top of the other. The number of calenders used determines the finish of the paper, and how slick it shall be.

Out of those calenders the paper comes, to be wound on huge rolls, called *jumbo rolls*, which are from 4 to 5 feet in diameter, 20 feet long, and containing from 4 to 6 tons of paper.

This huge jumbo roll is broken down further. It is cut into lengths of varying size and rewrapped into brown wrapping paper. Some of it is sent into the paper bag room, where clacking machines fold it, stamp it, and glue it into paper bags which are loaded in freight cars and sent to all parts of the earth.

But what has become of the discarded liquor from the digester tanks? The *recovery* of this liquid is said to be one of the most important in all the paper making business. The operation of this department determines whether or not the paper mill shall operate at a profit or a loss. Chemicals are the most valuable items in the manufacture of paper and they must be saved.

The solution, pumped into the *black liquor* tank, contains much organic matter from the wood and spent chemicals that must be revitalized before they can again be used. Therefore the black liquor is passed through a vacuum evaporator process and the expensive chemicals salvaged from the useless material gathered by the liquor in its work of breaking down the wood fibres. Much of the water is removed, leaving a heavy fluid. This fluid, to which sodium sulphate is added, is burned at a temperature between 1800 and 2200 degrees. The wood, or organic matter, is consumed, leaving sodium sulphide. This molten chemical is sprayed into a tank of water, dissolved, and in the caustic room lime is added. Over the furnaces are waste heat boilers, which send steam to help run the powerful turbines.



The finished product. The paper is now baled into 450 pound bundles, ready for shipment

Out of the caustic room comes the *sodium sulphide* and *sodium hydroxide*, which are the two active chemicals for cooking the wood into pulp. The strong cooking liquor, called *white liquor*, is then sent into the storage tank and thence into the measuring tank, where it is ready again for active use in the making of paper.

Everywhere in the plant, men are busy with their work and hardly notice a visitor. Chemists examine test tubes that contain the spent liquor to determine when the pulp has been washed enough. Employees stand before a series of meters, recording all that goes on in the plant. Throughout the ten acres of floor space, and the several floors of the plant, men who know their jobs are busy seeing that the right amounts of chemicals are added and that the huge digesters are filled. The deafening rumble and roar, the sour smells, the huge, slowly revolving lime kilns with molten white fires at one end, are all telling the story of a new industry which has come into the South.

In addition to the kraft mills, there are plants in the South now making fine white paper. Also, there are two mills, one in Texas and the other in Alabama, manufacturing newsprint—the paper upon which our daily and weekly newspapers are published. In addition, the paper and paperboard that comes from the mills creates other related industries.

The romantic pine trees of the South are providing the raw material out of which a great American industry is being developed.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Where is the paper mill located which is described in this chapter? With what historic event is the site connected?

2. In what ways is it an advantage for paper mills to be located on waterways?
3. What kind of paper is made in the mill described?
4. What kinds of paper are made in the South?
5. Into what groups may paper be classified?
6. How many major steps are involved in paper making? What are they?
7. What is meant by the term pulpwood? Pulp?
8. Where is the paper made in the South sold?
9. Is paper making a seasonal industry, or do the mills operate the year around?
10. How does the paper mill insure a constant supply of wood?
11. Do the paper mills own their own forests?
12. What is meant by the term *kraft* paper?

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Suggested Activity

1. Write an article in your own words on the subject: *How Kraft Paper Is Made.*

Chapter 10

THE NAVAL STORES INDUSTRY

ROSIN?" I asked. "How does it affect me as an individual? The only people I know who use rosin are violin players who rub rosin on their bows."

My friend smiled.

"Do you have any paint on your house?"

I had to admit that my house was painted, both inside and out.

"A good percentage of the ingredients in that paint was *rosin and turpentine*," he said. "Do you ever read the paper?"

"Certainly I read the paper," I replied. "What's that got to do with it?"

"Turpentine is used to help make the printing ink," he said. "Ever take a bath?"

I just looked at him that time.

"Rosin helped make the soap you used, and probably the soap dish that held it, if the dish was made out of plastic. When you stepped out on the linoleum, you were standing on a product rosin helped to make. The polish you put on your shoes had turpentine in it. There was even a little turpentine and rosin in your rubber heels. Both these products from the naval stores industry are used by everyone, every day. The largest use for both is probably in chemical and pharmaceuticals, as medicines and adhesive tape."

Normal Industrial Uses.—The wide variety of products in which naval stores are used is suggested by the following lists, presented under the subheads, turpentine and rosin:

Uses of Turpentine

Thinner for paints and varnishes, solvent for resins in lacquers and varnishes, in wood fillers, in wood stains, solvent for waterproofing compounds, solvent for rubber and other like substances.

Production of: Synthetic camphor, synthetic resins, terpinene, terpinolene, terpin hydrate.

Pharmaceuticals, including: Disinfectants, liniments, medicated soaps, salves, Haarlem oil.

As a mild fumigant in polishes: Paste shoe polish, furniture polish, linoleum polish, wax auto polish, floor polish, stove polish, copper polish, liquid floor wax.

Ingredients in cements: Metal cement, leather cement, rubber cement, laboratory cement for gastight joints, in insecticides, in some printing inks, in modeling and grafting waxes, stain remover, in tree insect bands, in stove enamels, in indelible laundry marking ink, in drawing crayons, lubricant in grinding and drilling glass, in ceramic work for application of colors, bleaching of bones for buttons, etc., in laundry glosses, in washing preparations.

Uses of Rosin

Manufacture of: Laundry soaps and soap powders, sizing for paper, paperboard, wallboard, ester gum and other synthetic resins, paint driers (resinates of lead, manganese, cobalt, and other metals; Japan driers), gloss oils, flat wall paints, antifouling paints, varnishes and lacquers, lacquer for food containers, axle greases, waterproofing compounds (insoluble rosin soaps), en-

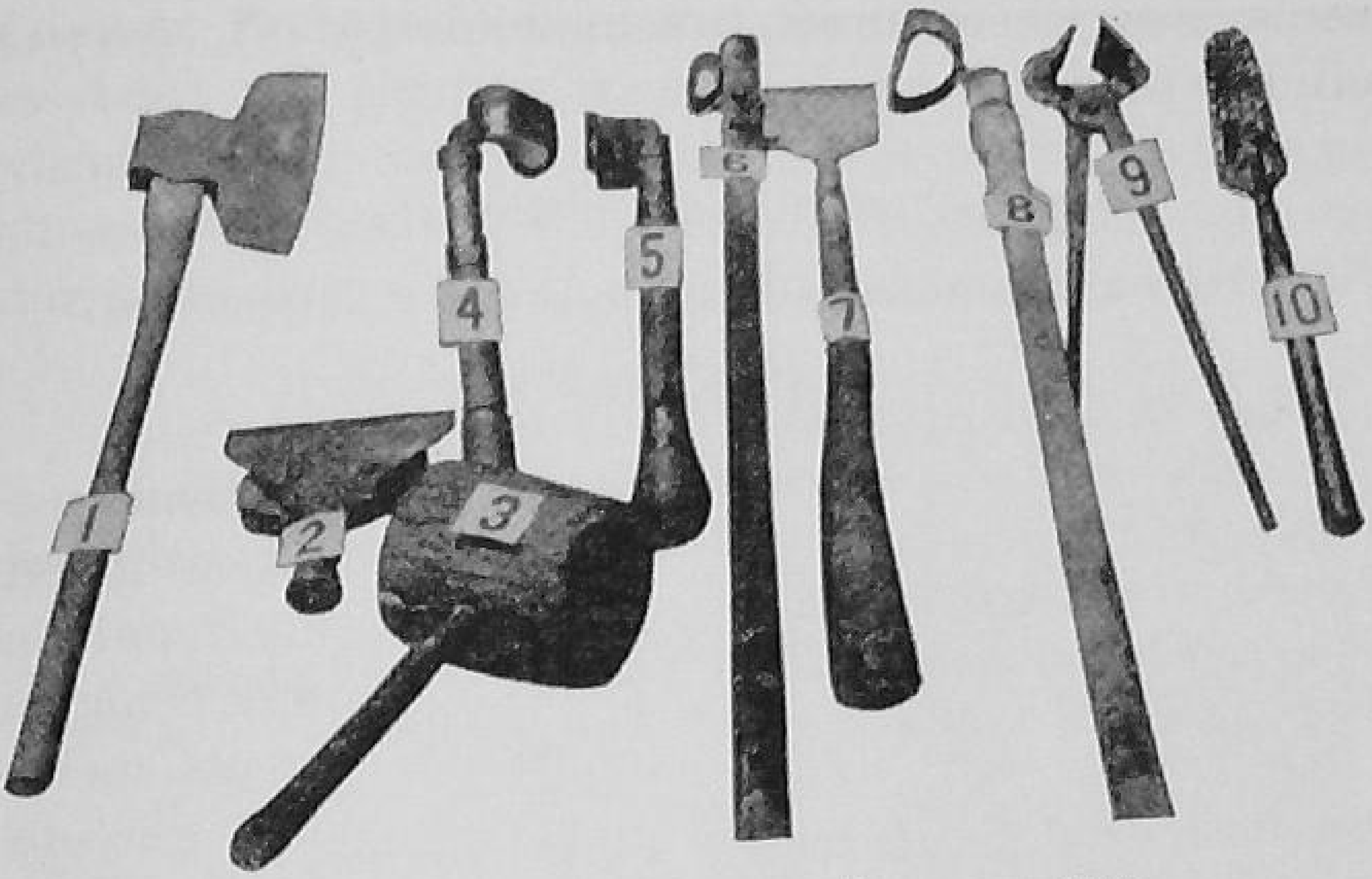
amels used in ceramics (resinates of heavy metals), sealing waxes, shoemaker's wax, grafting wax for trees, sticky flypaper, tree insect bands, coating for adhesive tape, belting adhesive, adhesive for wigs, matches, the cheaper linoleums and oilcloths, Venice turpentine substitute, munitions (matrix in shrapnel cases), fireworks, slushing oils for protection against rust.

Courtesy U. S. Forest Service

CHIPPING A STREAK WITH A HACK

As an ingredient in—cements: Optical-grinding holder, shoe-repairing cements, roofing cements, aquarium cements, metal-to-glass cements, glass-to-glass cements, silk-to-rubber cements, rubber-to-glass cements, vulcanized rubber cements, handle cements, battery seals, for coating wire, for coating nails.

Plastic wood, papier mache, belt dressings, wood preservatives, marking crayons, disinfectants as adhesive, sheep dip, boiler compounds, stove enamels, waterproofing compounds for paper, fabrics, woods, electrical insulating compounds, expansion-joint filler, roofing materials, insect powders, on violin bows, to remove hog bristles, to remove poultry pinfeathers, as solder flux, as filler on brush backs, for pipe bending, rosin soap as an emulsifier in asphalt, to impregnate sawdust for fire starters, for setting bristles in hair brushes, in wax tapers, to harden tallow candles, in boxing and wrestling rings, hot-spot cement.



TOOLS USED IN WORKING TREES FOR GUM

(1) Broadax; (2) Pringle ax; (3) Maul; (4) Hogal; (5) Hack; (6) Puller; (7) Pushdown scraper; (8) Pulldown scraper; (9) Gutter puller; (10) Dip paddle

Pharmaceutical purposes: Ointments, plasters, internal remedies (veterinary), disinfecting compounds.

In destrictive distillation to produce rosin oils used in: Cements, lubricants, belt dressings, printing ink, varnishes, rubber substitutes, shingle stains, waterproof- ing textiles, soap-making, leather dressing, shoe polish, sweeping compounds, funnel paint for yachts.

Pitch used for: Cobbler's wax, preserving nets, mak- ing waterproof paper, calking ships, electrical insula- tions (car batteries), plastics, grafting wax for trees and plants, paving materials, steel-hardening compositions, waterproofing masonry.

New uses are being added to the lists each year. Many are very interesting such as the new paint that prevents barnacles from attaching themselves to the bot- toms of ships, the rosin that goes into the construction and repair of runways on airposts, and the increasing

use in soap where formerly some imported oil, like palm oil, was used.

Consumption of Turpentine and Rosin

(Uses and consumers listed in order of importance)

Turpentine

- Chemicals and pharmaceuticals
- Paints, varnish and lacquer
- Shoe polish and materials
- Ester gum and synthetic resins
- Insecticides and disinfectants
- Shipyards and railroads
- Foundries and foundry supplies
- Adhesives and plastics
- Automobiles
- Furniture
- Floor coverings

Rosin

- Paper and paper size
- Soap
- Chemicals and pharmaceuticals
- Ester gums and synthetic rosins
- Adhesives and plastics
- Printing ink
- Insecticides and disinfectants
- Paint and varnish
- Oils and greases
- Linoleum and floor coverings
- Railroads and shipyards
- Matches
- Rubber
- Shoe polish and shoe-making materials

The Term Naval Stores

"Why use the term naval stores in connection with products that have so many uses?" I asked my friend. "The words, *naval stores* seem to suggest ships."

My friend was kind and patient enough to explain how the term naval stores came into existence. The business of getting gum out of trees and processing it for use is one of America's oldest industries. The process was very crude. In Virginia and North Carolina, which were

among the first producing states, the raw gum was poured into a pot and the turpentine boiled away into the air. The residue, or rosin, was then sent to the shipyards, where it was used to help caulk the seams of ships to keep them from leaking, to rub on ropes, parts of the

Courtesy U. S. Forest Service

Woods Rider Supervising the Hanging of Cups and Gutters

sails and other ship gear to protect them against salt spray and the elements. The use of rosin lengthened the life of the gear by many times. Because the processed gum was used largely in ship building and maintenance, it was given the name of naval stores.

However (my friend told me) the idea of using boiled tree gum did not originate in the Americas. Many centuries before Christ, the people of Asia were scraping raw gum off the trees and boiling it in pots along the shores of the Mediterranean Sea. They recognized the value of the oil being boiled off and made an attempt to

save some of it. They had no such modern distillery plants as we have today, though. They stretched sheep skins over the boiling pots to catch the vapors and then squeezed the turpentine out of the fleece.

An interesting side light on this ancient operation is that the oil wrung out of the sheep's fleece was used in mummy varnish, one commodity that withstood the ravages of the centuries, but which modern man in his infinite wisdom is still unable to duplicate.

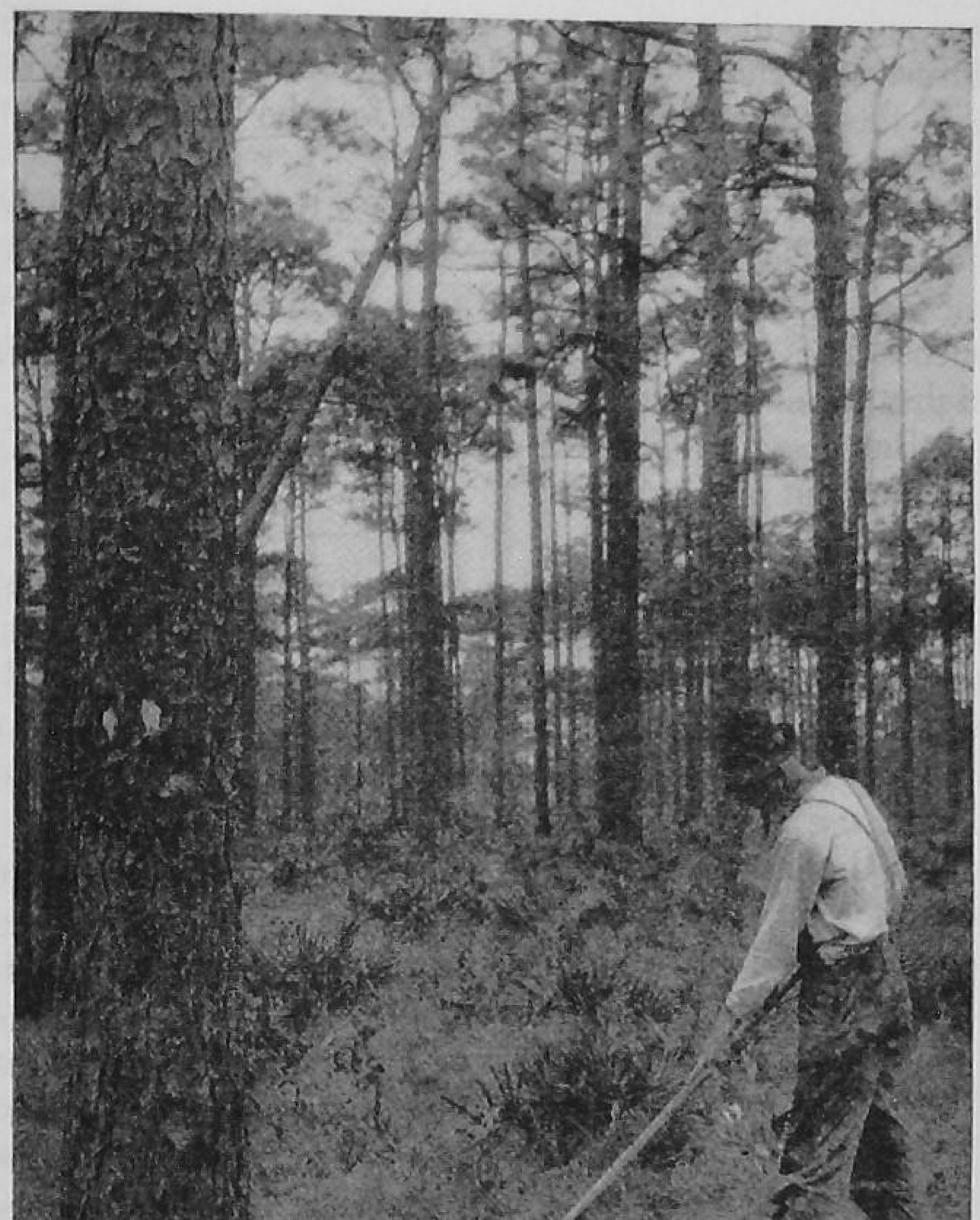
"But where does this gum come from?" I asked.

Being both the owner and operator of units of the naval stores industry from the woods to the processing plant, my friend carried me on one of the most interesting journeys I have ever taken into the woods. There he showed me where these products which effect our daily lives in so many ways, have their beginning, and the various stages of their journey from the woods to shipping containers.

We drove down a sandy road through a forest of pine trees which stood tall and golden-brown in the afternoon sun. As far as we could see, the pine flat with its carpet of grass and straw and its emerald canopy overhead, might have been one of the primitive forests of America. Except for one thing. At the base of each tree, except the smallest ones, was a patch of bright yellow wood and a metal cup. We got out of the automobile.

Raw Gum from Pines

"There is a variety of conditions here," he said, "and I can show you almost everything about the method of getting raw gum out of the trees. First, notice how all my faces are placed on the same side of every tree. That is to make the job of chipping and collecting gum easier for the woods worker. He doesn't have to hunt for the faces, like he would if each one was on a differ-



Courtesy U. S. Forest Service

RAKING CHIPS, STRAW, AND GRASS FROM AROUND TREES

ent side of the tree. Also notice that the faces in this forest are small and close to the ground. That means that the trees are being worked for the first time this year."

The trees are usually worked for a three- or four-year period. The face is chipped to a height of eighteen inches the first year and about sixteen inches for each succeeding year, and usually never total more than eighty to ninety inches above the ground.

"But doesn't it kill the trees," I asked, "to bleed all the gum out of them?"

He shook his head.

"That's a natural question, and almost everyone asks it. The tree is not full of gum, like honey in a honey-comb, as most people think. The sap wood of pine is almost free of gum before it is chipped or otherwise wounded. When the tender wood cells are cut or exposed, the mechanism of the tree sets up a process by which the gum is made and poured out over the wound to protect it. Since the face on a pine covers only about one-third of the circumference, this part of the tree is devoted to gum manufacture, while the remaining two-thirds of the cambium layer, or inner bark, which is the life line between the food-getting roots and the needles, or stomach of the tree, continues to carry food, and the tree continues to grow. There is very little difference in growth between those trees being worked for gum and those which are not."

He explained how turpentining was once a destruction factor to the forests. In early America and until around 1910, the trees were "boxed" by cutting a deep wedge shaped hole in the base of the trunk to catch the gum. This so weakened the smaller pines that many of them broke off at the base and toppled over in the first wind storm. Much gum was also lost by such a crude

arrangement. Since 1910 improved methods of collecting gum have been developed. Aprons and gutters were used to direct the flow of gum into a cup, from which it was emptied into a barrel or vat for transportation to the processing plant. Several methods or systems are used but they all follow the same general principle. The cups may be of the flower pot type or oblong shaped. They are made of clay, galvanized iron, aluminum, zinc, glass,

Courtesy Southern Region U. S. Forest Service

Barrels of Turpentine Ready for Shipment

or lead plated. The glass cups have been generally discarded as unsatisfactory since they break easily by freezing or rough handling. Rust proof cups which would stain the gum or distintegrate in the woods, are generally avoided.

The cup is installed as close to the ground as possible and the gutters and aprons placed immediately above it to direct the resin flow. There may be two gutters, which are pieces of metal bent into an angle, or one gutter and an apron, which is a flat piece of metal, or one or two aprons, depending on the system used by the individual operator. The gutters and aprons, from 1½ to 2½ inches wide and eight to twelve inches long, are inserted

into the tree by a broad ax and a maul, horizontal or angled, still depending on the system used.

Throughout the length and breadth of the turpentine belt the dormant season of the year is December and January, when the growth of the tree is at its minimum. Then the job of preparing a tree for its year's work gets underway. The rough bark is shaved thin with an ax, the aprons and cups inserted, and the lead streak chipped above the flat or crimped tin. Since the gum-producing cells are close to the surface, the streak is never chipped deeper than half an inch, and sometimes less than that. Care is taken not to cut, bruise, or injure the tree below the cut for gum, since the injury nearer the roots will heal first, the flow of gum will be greater there, resulting in a loss of resin which would otherwise go into the cup. The prepared tree is ready for its first gum. In February or March, depending on the latitude, the flow begins and continues until late fall. It's really not as simple as it sounds, though, for the trees must be worked throughout the whole producing season to insure a maximum flow. The cut is freshened every one, two, or three weeks, depending on the weather and flow of gum. A new cut may be made as often as twice a week during the hot weather of July or August when the cells of the trees are especially active. Each time a new streak is made, new gum ducts form and pour out a fresh supply of gum.

The cups are not necessarily dipped out each time a streak is made, but when the majority of them are full. Many times the operators will leave an extra cup at the bases of the healthiest trees so that the container may be changed if it is full before dipping time.

Some operators put more than one face on a tree at a time. This, however, is not good practice, since it impairs the growth of the tree, and produces no more gum.

At the beginning of the second year of working the face, the gutters, aprons and cup are moved up the tree to the base of the new face, and installed in the same manner as they were the first year. By raising the cup, the operator has less loss of gum and eliminates much of the sand, straw, bark and other foreign matter spattered

Industrial Department Seaboard Air Line R. R. Co.

Collecting Gum from the Flower Pot Type of Cup

in by the rain. Then too, fewer high cups are knocked off by livestock. Keeping the cup close to the working area of the tree is always an advantage. With proper working, the second and third years are the most productive. After that the flow of gum begins to decline.

"What's all that white stuff on the face of the cut?" I asked.

"That is gum," he replied, "which has oxidized and never reached the cup. We scrape that off, too. It

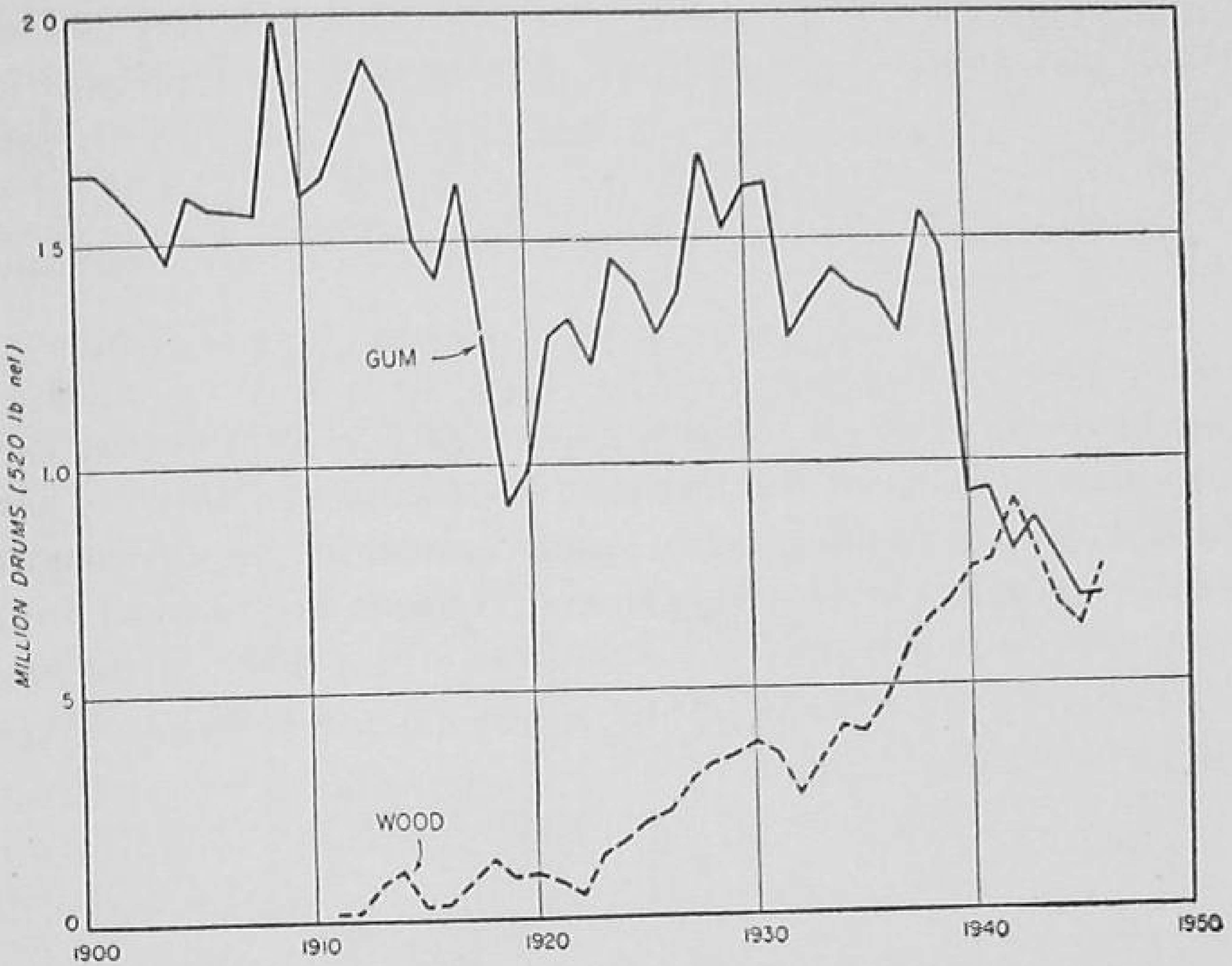
makes a low grade rosin, but accounts for five or ten per cent of the total yield from a slash pine tree and up to thirty per cent from the longleaf. It's better to pull off this scrape each time the trees are worked than to leave it there and take it off at the end of the season."

Sources of Naval Stores

Three-fourths of the world's supply of turpentine and rosin is produced by the southern United States. The other fourth comes from such countries as Portugal, Spain, France, Mexico, Greece, Honduras, Indo-China and others. Of the production in the United States, some eighty per cent of the naval stores is taken from live trees, the twenty per cent being processed from stumps and other fat wood. One industrial corporation has built quite an industry by following in the wake of logging crews and taking the stumps to be processed for naval stores. The stump privileges are purchased for a few cents per acre on land where they may have stood for years. They are blasted or pulled out of the ground with special machinery and hauled away to the processing plants where they are treated for a variety of products. This not only makes land easier to farm, but actually pays the farmer for waste material.

Rosin Production from Gum and Wood

This chapter is concerned primarily with what is often called *turpentining*, or the working of trees for the production of naval stores. Emphasis is placed upon this phase of the industry for the reason that this is the phase of chief concern to the owner of forest land in the turpentine belt. Turpentining is a part of forest management; naval stores are forest products to be harvested, just like pulpwood, poles, and other forest products produced for sale.



TRENDS IN PRODUCTION

A 50-year record in the relative production of rosin from gum and wood naval stores

But, as already stated, there is a second form of this industry which consists of taking rosin from the stumps of trees that are found by the millions throughout the section where longleaf and slash pines are grown.

Production from Wood.—The production of rosin from wood started about 1910. We may call it one of the chemical industries, since it was discovered by chemists and brought into being as a new industry by chemists and engineers. Since it was started, this phase of the industry has grown very rapidly. Soon after 1940, it was producing as much rosin as the gum phase of the business.

In his interesting book, *New Riches from the Soil*, Wheeler McMillen makes the following statements about this industry:

It would seem to be a fair presumption that no one in his right mind would go into the business of producing pine stumps. Nevertheless there is a market for such stumps after they have aged ten or fifteen years. More than three hundred common products derive certain of their ingredients from these old pine stumps.

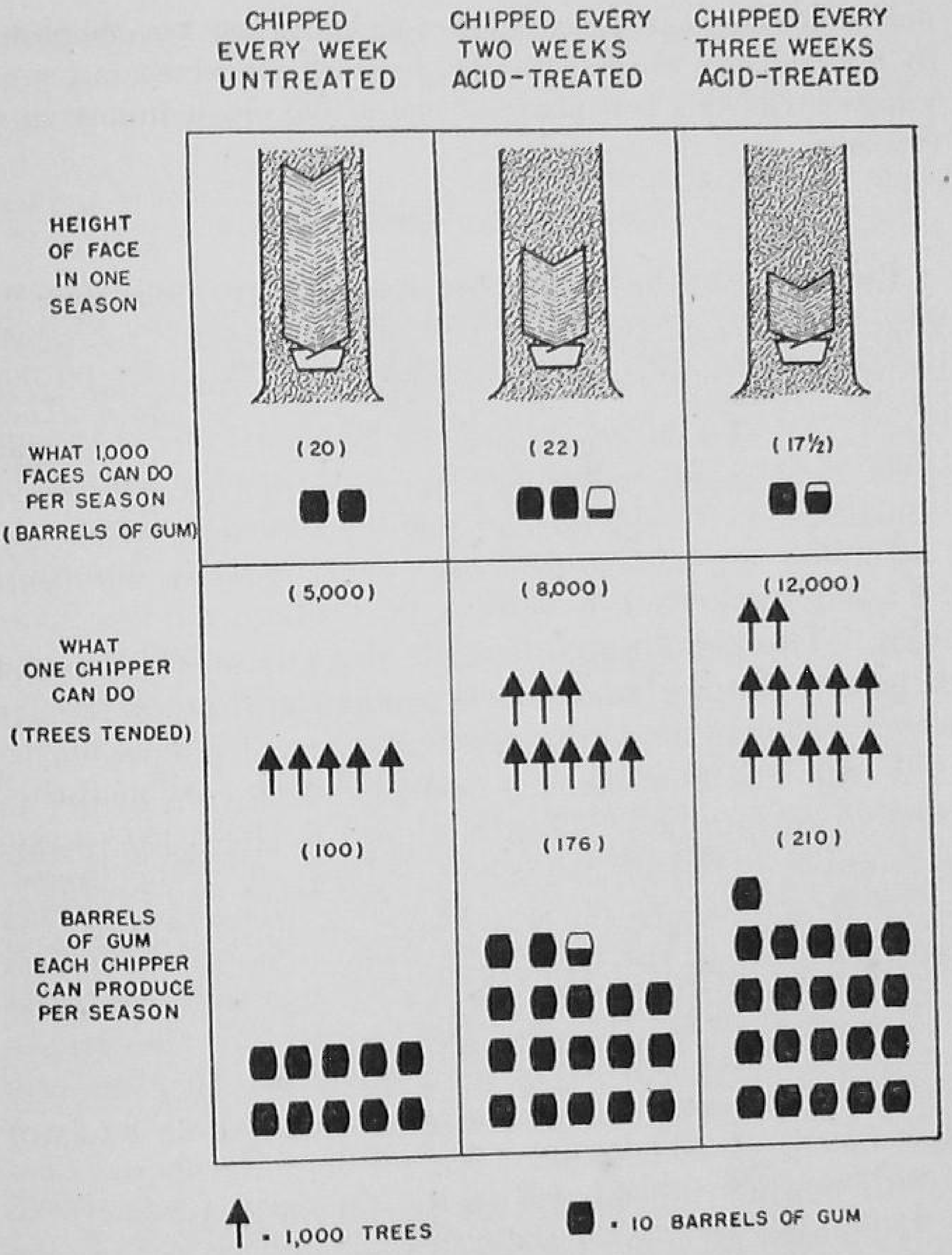
While no one makes a business of growing stumps, landowners in Florida, Georgia, and Mississippi have them by millions in their cutover lands. The stumps yield slowly to the normal processes of decay. They stand in the way of the plow. They hold land which might yield grass for cattle. They occupy spots where another tree might find room to grow. They are one example to the multitude of agricultural wastes. Their utilization not only adds to the wealth of the moment, but clears the way for future new wealth.

The heartwood of an old pine stump is a small storehouse of chemical raw materials. Modern power machinery exerts the force which concentrates these little storehouses into accumulations large enough to supply a chemical factory. Huge tractor cranes waddle into a stump field. A toothy device takes a firm hold on the stumps and the crane lifts them out of the ground. Then they are assembled into large piles. Here the big ones are split with dynamite charges and broken into pieces that are not too awkward to handle. Cranes load them on trailer-trucks or railroad gondolas for a ride that may be 125 miles long—they go to chemical factories for processing. They are procured by contractors who make arrangements to get them from landowners. The landowners are paid for the stumps. Contractors sell them to the industrial concern that processes them.

A powerful "hog" at the processing plant further reduces the size of the stump segments. The small pieces are then shredded.

Until the early nineteen-twenties the end products of the naval stores industry were but three in number—turpentine, rosin, and pine oil. The industry itself was as ancient as shipping,—the shipping from which the industry took its name. But no longer does the naval stores business look to the sea to market its goods.

Steam and solvents extract the turpentine, the rosin, and the



Results of Management Practices

Production by wood chipping at different intervals with and without acid treatment

pine oil from the old stumps. These in turn are subjected to chemical processes until new end products are obtained.

These products are the result of many years of research. Millions of dollars were spent in the studies that were con-

ducted by the chemists and other technical workers employed by the Hercules Powder Company, which pioneered in the development of this new phase of one of the oldest industries in the nation.

Turpentining Agreements

Returning to the segment of the industry dealing with gum production, several types of agreements are made between operators and land owners. Sometimes trees are leased by crops. A crop is 10,000 trees. The contract between operator and owner specifies the amount of time the trees will be worked and the rental on them.

Another type of contract provides that the operator give the landowner a certain percentage of the gross sales. The percentage depends directly upon the cost of getting out the gum, market prices and other factors which will give both parties a fair share of the profits.

Where it is possible, the best plan is for an owner to work his own pines. Then he does not share his profits with anyone, and he can see that his trees are properly handled to produce the maximum amount of gum and conserve them at the same time.

Slash and Longleaf Pine

Near the swamp I found a large pine which had not been faced. I asked why.

"It's not the right kind," my friend replied.

"I thought all pines produced turpentine," I said.

"They do," he agreed, "but only two species produce it in sufficient quantities to make the operation profitable. These are the slash and longleaf. They are found generally throughout the Coastal Plain and coastal regions of the southern states. The slash is the best tree of the two, since it grows faster and yields more and higher quality gum than the longleaf."

We climbed back into his automobile and drove slowly through the pine forest. Most of the trees were cupped, but now and then I spotted one which seemed to be of the same species as those we had examined, but without a cup. I pointed one of these out to him.

Industrial Department Seaboard Air Line R. R. Co.

TREATING STREAK WITH ACID

Treating the streaks with acid increases the rate of flow of gum and also keeps the gum flowing longer

"That one is too small," he said. "It doesn't pay to work trees under ten inches in diameter. They will not produce enough gum to pay for a man's time working them and the cost of processing. For instance a crop of 10,000 slash pine trees six inches in diameter will produce only ninety-four barrels of crude gum while the same number of fourteen-inch trees will turn out three

hundred and fifteen barrels. It takes two hundred or more barrels to show a profit."

He went on to explain that soil fertility, size of the tree crowns, weather and even tools also played an important part in the annual production of the trees. The use of dull tools in working a tree could cause as much as a 15 per cent loss in the amount of gum taken.

"Talking about small crowns," he said, "I've been trying to find a dry face to show you. You can tell a dry face because it looks red or darkly soaked with gum. A small crown on a tree is often responsible for the dry face, as well as too many faces on the tree, or chipping too deeply when the tree is being worked."

Results of Research

Just before we got back to the highway, he stopped to show me a forest of clean-bodied trees where he was trying experiments with the acid treatment developed at the Lake City, Florida, branch of the Southeastern Forest Experiment Station.

"Acid!" I exclaimed.

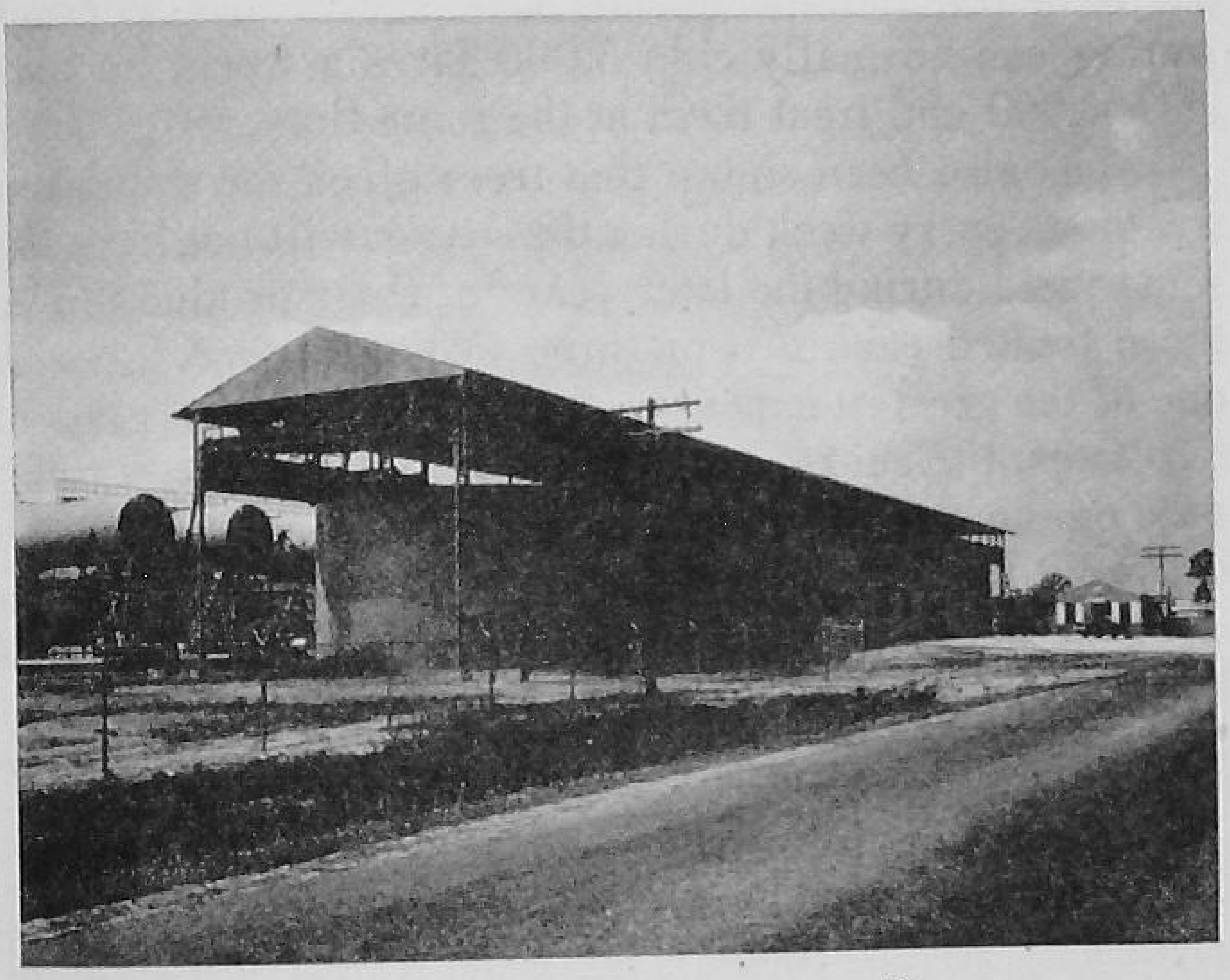
"We treat the trees with acid," he said, "to make them produce more gum for less money."

The experiments had been conducted since 1937 at Lake City on the use of chemicals to increase the gum flow. Many different kinds of chemicals had been used and a spray solution of sulphuric acid found to be the most stimulating to the flow of resin.

"We use a 40 per cent solution of acid on slash pines and a 60 per cent solution on longleaf," he explained. "This stand, which has been treated continuously for two years now, has yielded 75 per cent more gum than untreated trees of the same size and density. Many of the commercial operators using acid have raised their volume to around one hundred per cent. The best re-

sults are on virgin stands which have not been worked previously."

The acid, put on the fresh cut with a small spray gun, must be handled carefully to keep it off the metal strips and cups, which it will corrode, and off the clothes and



MODERN NAVAL STORES INDUSTRIAL PLANT

Showing the tanks in which products are held for processing and storage

hands of the operator to keep him from being severely burned. The theory of the acid treatment is that it collapses the tender wood cells lining the ducts, enlarging the duct openings and permitting a greater flow of gum. This treatment did not originate in America, but was started by German and Russian scientists years ago. Since its introduction into the American naval stores industry, it has proved effective from a yield and labor saving standpoint.

The acid treatment cuts down the amount of chipping necessary for an untreated operation. Instead of chipping once each week, the worker may chip his trees at two to three weeks intervals, treat the fresh streaks with acid, and obtain from 1½ to 2 times the amount of gum out of a tree. Experiments have shown that where a worker can normally chip 5,000 faces a week, he may chip 4,000 and treat them at the same time.

It has also been shown that trees given the sulphuric treatment every week during the season will not have the same yield during the later years of their production as those treated each two or three weeks. Since labor is one of the greatest expenses in working a crop of turpentine trees, the acid treatment has shown a marked influence on the cost of producing raw gum, as well as on the net profit from the operation.

From one to one and one-half quarts of the acid will treat one working of every thousand faces.

Treatments Recommended

The following information concerning the use of stimulants for increased gum yields is based upon a report written by H. L. Mitchell, Southern Forest Experiment Station:

Virgin faces and early work.—If acid is used, it is not necessary to apply advance conditioning streaks during the winter or early spring. For best results, each of the first six to eight streaks should be treated immediately after chipping. Records on experiments and commercial operations show that eight acid treated streaks on virgin faces will produce from 50 to 100 per cent more gum than the same number of untreated streaks on comparable timber. Although acid treatment is especially effective on virgin timber, it will also increase the early season yields of yearling and older faces.

Periodic acid treatment.—The application of sulphuric acid, immediately after chipping, to all streaks chipped during the

Method	*Intensity of Chemical Treatment*	*Gum yield per 1,000 faces of average timber in barrels per season **	*Number faces one chipper can work during season ***	*Total season's production of one chipper in barrels of gum*
Weekly chipping—no chemical		20.0	5,000	100.0
Biweekly chipping—no chemical	Untreated	9.4	10,000	94.0
Triweekly chipping—no chemical		7.4	15,000	111.0
Weekly chipping and acid treatment	Intensive	31.0	4,000	124.0
Weekly chipping and biweekly acid treatment		27.0	4,500	121.5
Biweekly chipping and acid treatment	Conservative	22.0	8,000	176.0 £
Triweekly chipping and acid treatment		16.0	12,000	192.0 £

* Assumes timber of average quality, half slash and half longleaf, capable of producing 200 barrels of gum per crop (10,000 faces) per season for 32 weekly, untreated streaks ½″ high by ½″ deep.

** Assumes that chipper can chip 5,000 faces per week; time studies show that on average a chipper can both chip and treat 80 per cent of usual number of faces.

£ For maximum efficiency and profit per tree biweekly and triweekly schedules for chipping and acid treatments are recommended.

spring and summer months. Weekly streaks treated with acid produce from 50 to 60 per cent more gum than untreated streaks at the same frequency.

Skip acid treatment.—Timber is chipped weekly and fresh streaks treated with sulphuric acid every other week. Timber thus treated will produce from 30 to 40 per cent more gum than untreated timber chipped weekly according to current practice.

The previous table shows the season's production which might be expected from one chipper if he operated according to each of seven different methods:

To date no evidence has been found to show that chemically

treated trees are less healthy or more subject to dry face than timber turpentined according to usual practices. The application of acid oftentimes results in a condition which in some ways resembles and is frequently mistaken for dry face. It is apparently caused by the action of the chemical on wood and bark tissue with which it comes in contact.

The acid condition differs from dry face in that the lightwood neither penetrates deeply into the wood nor extends to a considerable distance above the face. No signs of reduced gum yields have been detected.

Care should be used to prevent the acid from dripping on metal gutters, aprons and cups as excessive corrosion due to the action of the acid on the metal reduces the life of the equipment and may contaminate the gum with iron and thus affect its grade. Covering the tins and cup with a chipping paddle made of acid resistant cloth or some other resistant material will reduce the risk of corrosion due to excess solution from carless or overgenerous application.

The following equipment and supplies are needed:

Sulphuric acid—ready-mixed into 40 or 60 per cent solutions.

Spray guns—the Florida lung power spray gun.

Bark or regular hack.

This equipment, as well as the supplies, may be purchased from various factorage houses and equipment dealers. If bark chipping is done, the bark hack and special stones for sharpening this tool can also be secured from the above sources.

Caution and care should be used constantly when mixing, handling or applying sulphuric acid. The chemical is highly corrosive and will eat through ordinary clothing and may cause serious burns if handled carelessly and allowed to remain on the skin. There are many safety devices and precautionary measures which will prevent destruction of clothing and minimize the danger from burns. Some of them are (1) wearing aprons made of specially treated acid-resistant cloth, (2) applying heavy coating of grease to leather shoes or wearing heavy rubber boots and (3) having the laborer applying the chemical carry a pint bottle of plain water.

Immediate and thorough washing with plenty of water will prevent burns from acid accidently spilled on the skin. Exposure to acid is not harmful if the chemical is washed off immediately with plenty of water. Prolonged exposure, however, results in burns. Clothing accidentally wet with chemicals should be removed at once and the skin thoroughly washed.

For acid in the eye—wash as quickly as possible with large quantities of water and then wash with lime water.

For acid on the skin—wash as quickly as possible with large amounts of water, then cover the injured area with a pasty mixture of baking soda and water or any ordinary cooking oil.

If acid is swallowed—give a large dose of milk of magnesia followed by raw egg whites and any vegetable or mineral oil.

If burn is severe, take the patient to a doctor after the proper first aid treatment is given. Prompt first aid, however, generally will prevent serious injury.

Hybrid Pine

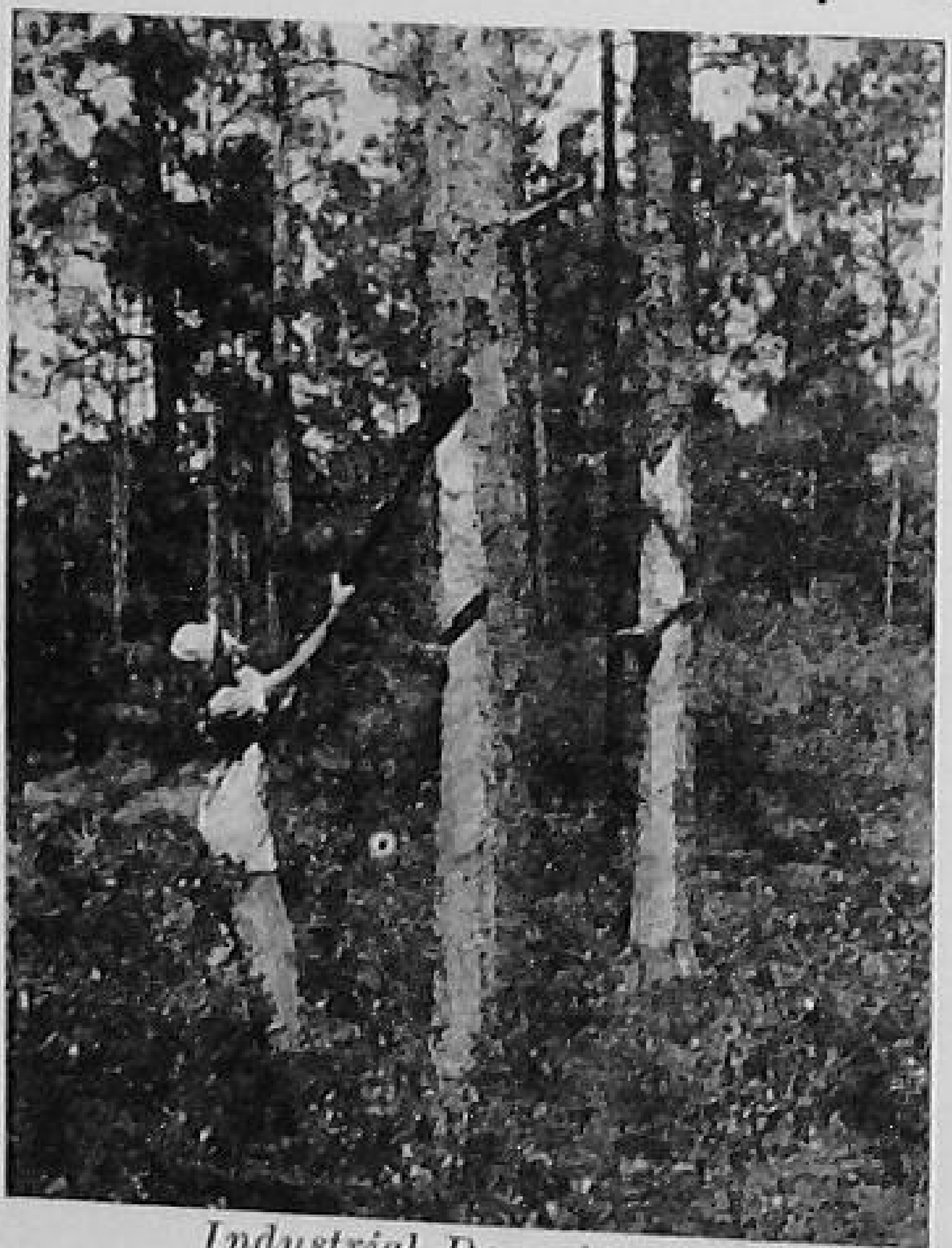
Another recent development in the naval stores industry is the attempt to produce a hybrid pine that will increase the gum yield, as, for example, was done in the growing of corn. A large number of trees were studied and those with the greatest gum flow selected. High-yield slash were crossed with other high-yield slash, as well as with longleaf. Because of the dates in which the flowers of slash and longleaf appeared, it was sometimes necessary to hold the pollen from one tree over for a year and use it the next. Canvas bags with windows in them were tied around the pine flowers, which were watched until they were ready for the pollen, which was then injected into the bags. The seeds from the cones artifically bred in this manner were carefully saved and planted.

Successful cutting from pine twigs have also been made from the high yield pines. Over many years the highest yield trees will be saved by the selection method, and eventually a race of trees developed for its gum pro-

ducing qualities. The scientists claim that it is possible by this system of selection to produce ultimately a pine tree capable of producing *twenty-four times* as much gum as those trees which now grow normally in the rough woods.

A Modern Still

We turned up the highway and drove to my friend's turpentine still, the final step in the production of those two products which flow out of the resin ducts of the pine tree. The still was a far cry from those pots where the early colonists boiled tree gum for the pitch alone. It was a plant constructed mostly of metal to decrease the risk of fire to the highly inflammable products. In it was modern distillery equipment that costs thousands and thousands of dollars—boilers, copper tubing, vats, drums and other necessary high priced gadgets.



Industrial Department Seaboard Air Line R. R. Co.

An Evidence of Poor Management

Chipping trees by the old methods "worked out" the tree too quickly. The acid treatment has resulted in a higher level of efficiency

Here the raw gum was dumped and heated to a temperature of 330 degrees. Water and turpentine were distilled together into a tank. The lighter turpentine was piped off the top and the water off the bottom. The turpentine which came off in two grades, either *water white* or *standard*, the latter with a yellowish cast, was emptied into drums ready for shipment.

The rosin was processed further by screening it through two sizes of mesh to strain out the chips, trash, sand and other impurities and then through cloth to further purify it. The final product ran the gamut of the alphabet backward from X, which was almost white, to D, a dark red. Between these two, twelve grades have been set up by the U. S. Food and Drug Administration. The industry itself has a special name for each one of these grades, as Extra, Waterwhite, Windowglass, Nancy, Mary, Kate, Isaac and so on down the list.

"A still is never justified," the operator said, "without at least six crops to keep it going. Our still here takes care of ten crops, or around 100,000 trees. Some of the larger stills process the gum from many more crops."

Manufacturing.—The old country, fire still is disappearing. In its place is the new, modern, high-temperature processing plant which serves a larger area more efficiently.

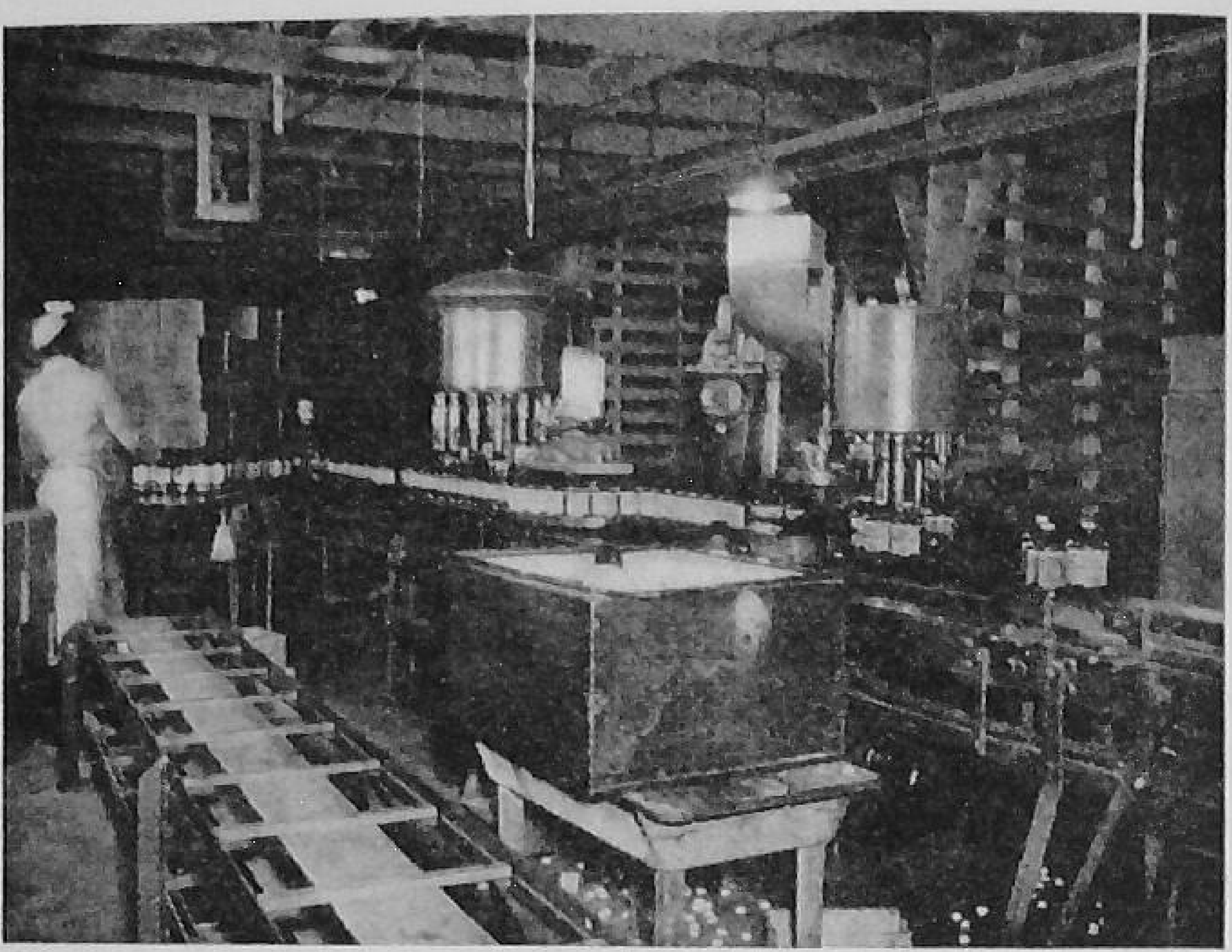
There are four manufacturing or processing methods followed. These are:

1. Gum processing, the most common method, in which the oleoresin that is caught in cups is collected and taken to stills where, through distillation, the turpentine is condensed from the rosin. These products are known as gum naval stores.

2. Destructive distillation of dead wood and stumps. By this method turpentine, pine oil pine tar, pine tar oil, and charcoal are produced and termed wood naval stores.

3. Steam distillation, solvent-extraction process in which dead wood and stumps are ground and steamed with live steam to obtain turpentine and pine oil, then extracted to obtain rosin.

4. As a by-product of the sulphate process of manu-



Courtesy American Turpentine Farmers Association

INTERIOR OF NAVAL STORES PLANT

Showing the equipment for bottling gum turpentine in the containers in which it is sold in retail stores

facturing wood pulp, which is discussed in connection with the making of paper and cellulose products.

Thus wood becomes, through applications of chemistry and engineering, a new raw material for industry that turns out an ever-increasing number of useful products.

Fires.—Fire is a constant menace to turpentine timber. The damage done by it each year in the turpentine belt runs into millions of dollars. There is no section of the nation where a larger per cent of the forest area is burned each year than in the region where naval stores are produced.

Trees with highly inflammable faces which are covered with crude gum are very susceptible to damage by fire.

A severe uncontrolled fire in a forest that is being worked for turpentine will do untold damage. Not only are small seedlings killed but large trees are often damaged to the extent that they will die. Cups and aprons that are burned are often destroyed. Fire also melts the zinc on galvanized cups and aprons thus exposing the iron which will rust. Raw gum contaminated with iron rust from rusty cups and aprons is likely to lower the quality of rosin as much as three or four grades, which, of course, reduces its market value.

Trees with faces that have burned destroying the coating of gum are attacked by turpentine borers. When a large number of this insect species bores into the heart of a tree they help to cause enough mechanical damage to cause the tree to be blown down by the first strong wind. In some areas one hundred per cent of the burned faces show that borers have entered the trees. Faces that have burned heal very slowly.

If the foliage on trees is burned or damaged by fire the flow of gum is greatly reduced.

For years it has been the practice on most tracts, being turpentined, to remove the straw, grass, chips and brush from around each tree that is cupped. This lessens the damage in case of fire, since fewer of the faces are burned. Often the forests are purposely burned after trees have been "raked." When this is done, the fire is set when the litter on the forest floor is damp and at a time when there is little or no wind blowing.

Even when forests are burned in this manner great damage is done. Practically all the small trees are killed which prevents natural reproduction. The soil mulch, of decayed and decaying vegetation which holds moisture in soils, is also destroyed.

It costs much more to "rake" trees than to provide good fire protection. Since fires are so prevalent in the

turpentine region it is very important at the end of each working season to use some method of control. In some states where naval stores are produced laws have been passed dealing with the conditions under which burning may be practiced. It is advisable to secure copies of

Courtesy American Turpentine Farmers Association

Turpentine Stand in Third Year of Working

Cups have been raised twice since first working

these laws or statements dealing with the laws from state departments of forestry.

Some Conclusions

One interesting thing I learned about the turpentine business was that a man could get into it without too much capital. A few hundred dollars for the purchase of tools, cups and other working parts and a lease agreement with the landowner is all that a producer needs to begin. There are few spots in the slash and longleaf

belt where cash markets are not readily accessible. Turpentine stills are scattered throughout the length and breadth of this belt and they will buy the raw product all during the year. In addition, the operator does not have to work a full crop. Any quantity of the gum may be sold at a time.

A few years ago the naval stores industry was thought by some to be on its way out. Through the work of the American Turpentine Farmers Association Cooperative, the Forest Farmers Association, the experiment stations and private companies who have spent tremendous funds in promotion, research, and equipment, the industry is today larger than it has ever been. New uses have been found for turpentine and rosin. Cumic acid is one. Toxaphene, a powerful insecticide, is another. There are many, many more, which are each year creating a greater demand for these products from the southern pine trees. Almost fifty million gallons of turpentine and more than one and one third billion pounds of rosin are consumed by the world today in the manufacture of its many products using these ingredients. The production has been climbing steadily since those days more than twenty-five centuries ago when man boiled down the gum in a melting pot in the shores of the Mediterranean Sea and caught the magic oil in the fleece of a sheepskin.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are *naval stores?* Why was this name given to the industry? Tell something of the ancient methods and uses of naval stores.
2. When was the industry started in this country? Why?
3. How are some of the ways in which you use turpentine and rosin in your daily life?
4. What is a face? Why is it desirable to put all faces on one

side of the tree? What does it indicate when they are close to the ground? How many trees in a crop?

5. From what two species of trees are the bulk of turpentine and rosin reproduced? What is the natural range of these trees?
6. Explain how and why a tree produces gum?
7. What is *boxing?* How was it once a destruction factor in the naval stores industry? What new process is in effect today?
8. What are aprons and gutters? How are they used? Where is the cup placed and what is its job?
9. When is the "dormant season" in the turpentine belt? How is this period used by operators? When does the flow of gum start? When does it stop?
10. Why should care be taken not to cut, injure or bruise the tree below the cup?
11. How often is the cut freshened? The gum dripped?
12. Why should only one face be worked at a time on the tree? Explain the reasons for raising the cup at the beginning of the second season.
13. What is "scrape"? How does its yield compare between slash and longleaf pine?
14. How much of the world supply of turpentine and rosin are produced by the United States? Name some of the other countries producing naval stores.
15. Most rosin and turpentine are produced from live trees. What is another source?
16. What are the methods used to engage trees for turpentining? Name two types of agreements between operator and land owner.
17. Do all pines produce turpentine? Which tree yields the highest quality gum?
18. When trees are worked for naval stores, at what diameter will they pay a profit? Why? What are some of the other factors influencing the amount of raw gum from a tree?
19. What new recent development produces more gum from a tree? Explain how it works. Name two ways in which it helps in the net profit from a crop. Why must you be careful with this new method?

20. Name another new experiment designed to increase the amount of raw gum a tree will produce. There are two ways in which the experimenters are working with this development. Do you know what they are?
21. Where does the gum go when it is brought out of the woods? How is it treated?
22. Name the two grades of turpentine. Why is the rosin screened? What are some of the trade names for the different grades of rosin?
23. How many crops of trees does a still need to justify its existence?
24. Name two associations promoting the use of turpentine and rosin. What are some of the newly discovered uses of these products?

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Suggested Activities

1. If living in the naval stores belt, make a study of the methods used in turpentining. Do the methods follow the newer practices recommended in this chapter? List these and check each.
2. If living in the naval stores belt, visit a processing plant. Find out what methods are used in management and operation. How large an area is served? What methods of extraction and processing are followed? How do these compare with those used ten or more years ago?
3. On an outline map of the United States or the South, indicate the area where naval stores are produced. From production records published in the annual yearbooks of the U. S. Department of Agriculture, determine the rank of the states in total production.
4. Outline the steps used in the acid stimulation method and list the advantages and disadvantages.
5. Determine how much money is made per acre from the naval stores products that come from the forest.
6. What practices and policies are followed, if any, with respect to burning over the woods in the naval stores section of your state, if you live in such a section. If you do not live in such a section, but do live in a state where naval stores are produced, then secure this information from your state forest service.

Chapter 11

OTHER FOREST INDUSTRIES

In addition to lumbering, paper making, and naval stores, there are many other forest industries.

Among the other interesting wood-using industries that may be included among those adding to the wealth and employment opportunities in the South are those which were created by chemical research, those related to house building, plywood, cooperage, and wood preservation. Then, there are a great group of industries engaged in the making of boxes, baskets, and containers. Also, there are many farm-and-home industries based upon the use of wood and forest products.

Let us consider some of the industries typical of these groups!

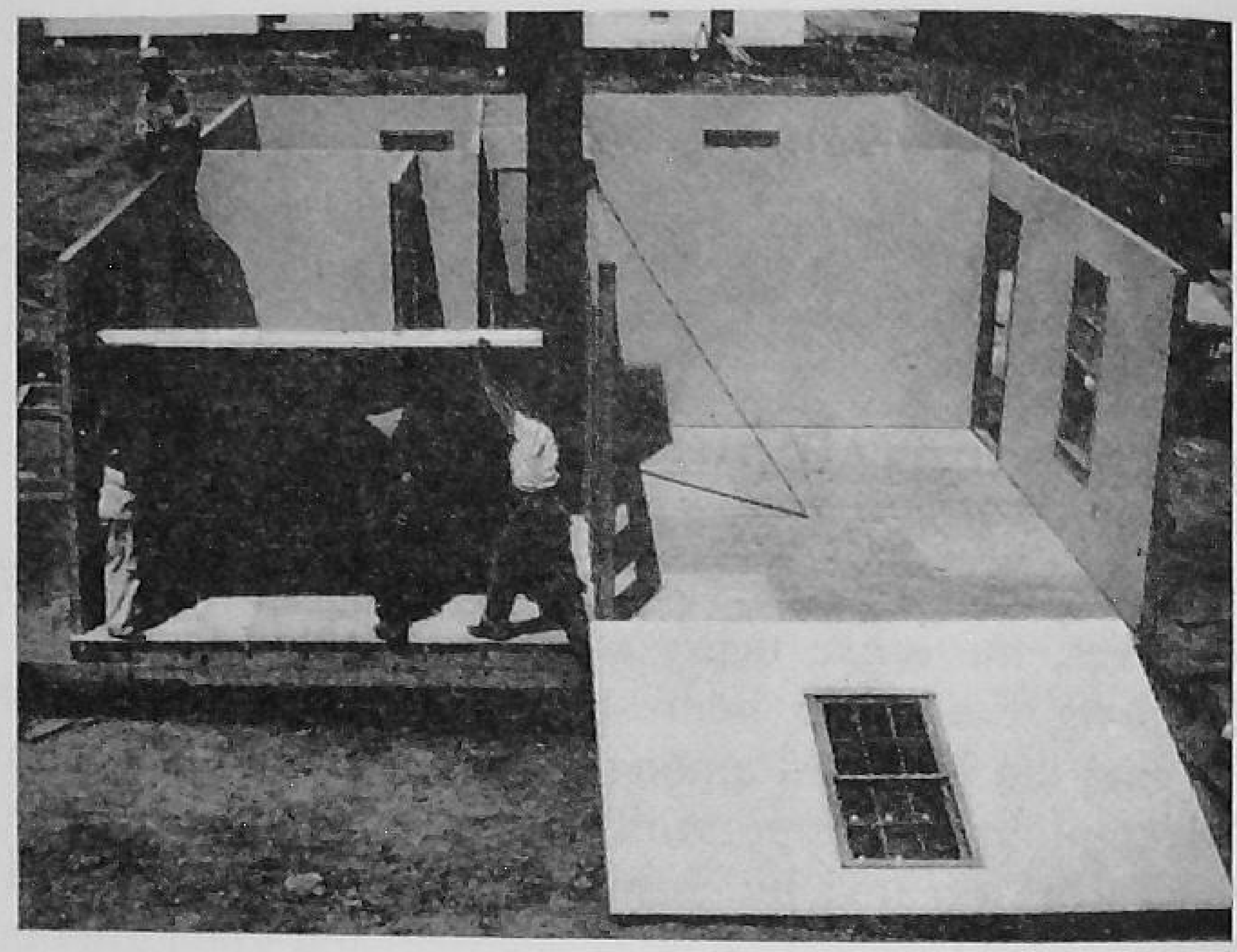
Chemical Industries.—Do you know the meaning of the word *chemistry?*

Chemistry is the science that deals with the substance of things and the changes that take place in all such substances as food, soil, wood and the other materials we use and see all about us.

Men and women who study the changes that take place in substances are called chemists.

For many generations chemists have been attempting to find new uses for materials by controlling the changes that take place in them, or the changes that can be made.

Chemists have found many new uses for materials. They found, for instance, how to make paper out of wood.



Erecting a Pre-Fabricated House

Also, they discovered how to make many other products from wood. The business of making these and other such products is sometimes called *chemurgic industry.*

The word *chemurgic* is a new word. It is really a combination of the words *chemistry and agriculture.* It means that agricultural products, including wood, through changes brought about by chemistry may be used as the raw products for industry—new industry that did not exist before discovered by chemists.

There are dozens of chemurgic forest industries now in operation in the South. Rayon, paper boxes, camphor, and alcohol are among the products made. There are many others.

Rayon.—Rayon, as you know, is a textile product from which clothing and household furnishings are made. But what is rayon? From what raw materials is it made?

Rayon may be made from several raw materials. Among these raw materials are pine trees.

The shirt, dress, or suit you are wearing may once have been a tree. The tree was reduced, or changed, to *cellulose,* which was mentioned in connection with the making of paper, and then, by chemical processes, the cellulose was converted to cloth and then to garments and other useful articles.

Rayon is made in very big factories in which many workers are employed. There are a number of such factories in the South.

Paper Boxes.—The pulp, or so-called paper plants are chemical industries. They convert wood to the cellulose form, as described in the chapter *How Paper is Made.* Then the cellulose may be used to make many products such as what we call cardboard. There are many uses of cardboard; it takes on many forms. One of these uses is that of making paper or cardboard boxes. For example, the boxes in which suits and dresses are placed when bought in department or clothing stores. Many products—candy, breakfast foods, and toilet preparations—are packed in cardboard boxes. The making of these, and other cardboard containers, is an important industry. It gives employment to many people. It is a forest industry.

Camphor.—In the Orient there are trees that, through Nature's processes, produce camphor. Such trees grow in a restricted area—very largely in a country called Formosa.

At one time the Japanese gained control of Formosa. This meant that they gained control of the world's supply of camphor.

As soon as this was done, the Japanese increased the price of camphor. They thought people would be compelled to buy from them, since there was no other source of supply. But they did not reckon with America's chemists.

American chemists found out that camphor could be made from southern pine trees. Now it is not necessary to depend upon the Orient for camphor. It is made in the United States.

Camphor is used in the making of photographic film. It is used in making many plastic-like materials such as motorcycle windshields. One of our great chemical corporations, Du Pont, now makes more than one-half a million pounds of synthetic camphor every month.

Alcohol.—Alcohol is another chemurgic product made from wood. During World War II, when it was important to use large quantities of alcohol, our government erected a great plant for producing the product from wood.

It is important to know that chemistry has made possible so many uses of southern trees. Those mentioned are merely examples. There are countless others.

One other important chemical industry in the South that makes use of wood is operated by the Hercules Powder Company.

This company buys stumps, and, by chemical processes extracts from them many useful products. These products are used in house-hold cleaners, wax paper, ink, phonograph records, paints, varnishes, and paperboard.

There are stump-using plants in several states including Florida, Georgia, and Mississippi.

This is an important industry. The stumps, of which there are countless millions, would have no value but for this industry. Yet, they sell for large sums of money. The plant at Hattiesburg, Mississippi, in one recent year, for example, paid farmers more than $500,000 for stumps.

Plywood.—Do you know what plywood is? The industry says it is "*a wood and glue sandwich.*" One

writer says it is logs, labor, and glue. Actually, of course, it is thin pieces of wood glued together under high pressure.

Making plywood is a by-product of lumbering.

U. S. Forest Service

ASSEMBLING GARDEN TOOLS

Only twenty-eight per cent of the tree is used in lumbering, as a rule. This means that lumbering operations are very wasteful. Almost three-fourths of the wood is lost in a normal or typical lumbering operation. But plywood saves a goodly portion of what was once waste material. This material has many uses. It is very strong. It will stand greater weight and strain than ordinary lumber of the same thickness. And most of it looks very attractive, too.

Making plywood is an important industry. There are forty or more plywood plants in the South. Almost

one-half of these plants are located in North Carolina.

Plywood is made from veneer; that is, the thin sheets of wood that are made in veneer plants. There are many such mills widely distributed throughout the South. Veneer is used in many ways, other than in the making of plywood. It is used, for example, in furniture factories.

To make plywood, sheets of veneer are laid with the grain—in the wood—of adjacent sheets at right angles to each other. Then glue, or some adhesive, is applied to the sheets. To make them stick together, the glued-together sheets are put into a press and heated to a very high temperature. Within two days after being removed from the press, the plywood is ready for shipment. More than 25,000 workers are employed in southern veneer and plywood mills.

Baskets and Boxes.—The making of baskets and boxes is a very important wood or forest industry. Boxes and baskets are used in numerous ways. They are required for the marketing of farm products—oranges, fruits of all kinds, vegetables, potatoes, and many other commodities. They are used, too, for packing the products made in many southern factories; for example, the packing of cigars.

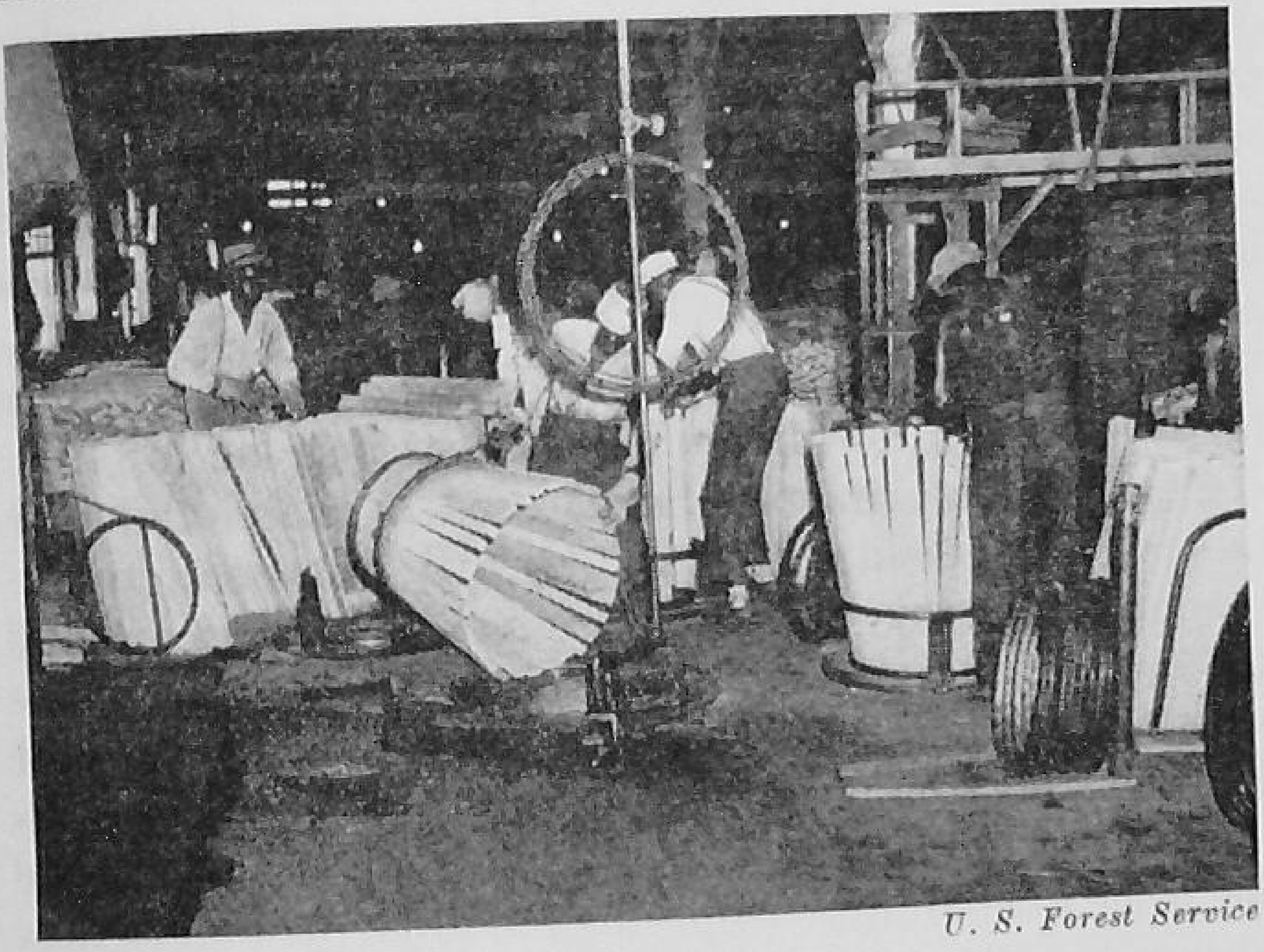
There are more than 150 box-making factories in the United States engaged in making containers for farm products. There are several such plants in every southern state. Texas and North Carolina are among the leading states in the nation in this industry.

Florida, as you know, is one of the leading cigar-making states in the nation. It is also a leader in the making of cigar boxes, as well as wooden boxes of all kinds. More than 25 million dollars is earned every year by the makers of boxes in the South.

Cooperage.—Cooperage is an industry related to the making of wooden boxes. It is the business of manu-

facturing barrels, hogsheads, tubs, pails, kegs, and other containers that are made of *staves.*

There are 350 cooperage establishments in the United States of which 100 are located in the South. Virginia leads all states in the region with about 40 plants; Florida ranks second and Tennessee third among the southern states in this wood-using industry.



U. S. Forest Service

A COOPERAGE PLANT

Making barrels from white oak staves in a plant at Memphis, Tennessee

Pre-Fabricated Buildings.—Pre-fabricated buildings are those constructed in a central factory and shipped to the place where they are to be erected and used. Thousands upon thousands of houses are now made in this way.

In plants scattered widely throughout the South, factory-built houses, and barns, and garages are being made.

At the factories the houses are made in large sections—for example, one entire side of a room. Then, the sections required to put together a complete house are hauled by truck to the lot where the house is to be erected. Here the sections are assembled.

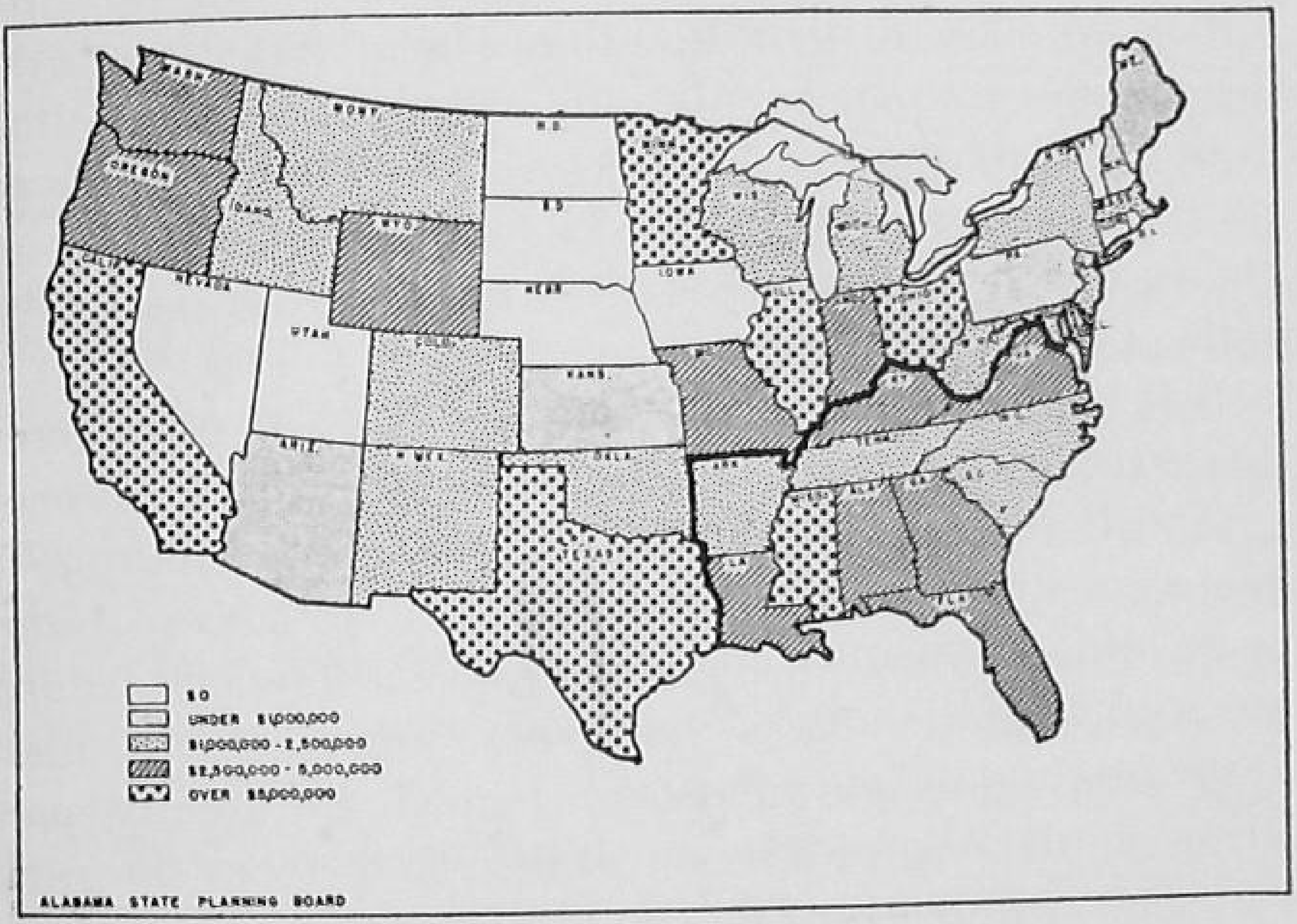
By employing this modern construction method, it is possible to erect a small house on a lot in one day, provided, of course, that the foundation has been made previously and that the plumbing work, up to the foundation, has been completed. This means that the water and sewer pipes have been installed in the foundation and are ready to be connected with the pipes from kitchen and bathroom.

It is thought that by this new method of construction that the cost of building small houses may be lowered. It is the same principle that is used in the clothing industry. At one time in the past, all suits were tailor-made; that is, they were made-to-measure, when ordered by a customer. Now, however, manufactures make suits, and other garments, in factories. Ready-made garments may be purchased at any time from the racks and shelves of clothing stores. This method has reduced the price of clothing. Applying the same principles may also reduce the cost of homes and other small buildings.

Whether factory-built houses will set the pattern for future home and small-building construction remains to be seen. The method is still too new for any final verdict to have been rendered. There are several advantages to the method, especially to persons living in small towns.

One of the major advantages to factory-built or prefabricated houses is the high-quality of interior finishing work that may be done, especially with respect to built-in conveniencies such as bookcases, kitchen cabinets, and other interior features which become part of

the house rather than furnishings of the houses. Such features are attractive, convenient, and desirable. But in small towns it is often difficult to find skilled cabinet makers to do such work in connection with or as a part of house-building. In larger towns and cities there have always been wood-working shops, planing mills, and



Wood Preserving Plants

cabinet-makers establishments that have done such work along with the making of doors, window frames, and other essential house parts.

House-building, regardless of how the work may be done, is, and will remain, one of the all-important wood-using industries.

Also, the erection of farm buildings—barns, poultry houses, and other structures, including fences—increase in importance as agriculture is diversified and livestock enterprises are added to more and more farm production programs.

Preserved Wood.—Wood preserving is an industry of growing importance. It is concerned with treating wood to make it resistant to fire, decay, and injury by insects. More than 14,000 persons are employed in this industry, which has 75 or more plants in the South. Texas and Mississippi are leading states in the nation in this forest industry.

It is possible to treat wood so that it will not burn. The process was discovered and perfected at the Forest Products Laboratory, Madison, Wisconsin. Here, at one time, a fire destroyed a building in which treated lumber was stored. This lumber was charred at the ends of the boards, but did not burn. Since that time the process has been perfected and is being extended in use.

The treating of lumber to prevent injury by termites is important in house-building. If the sills are treated before construction, termite injury is prevented. There are several ways in which this can be done. One way is to soak the sills in a creosote vat; such a vat as is used for the treating of fence posts.

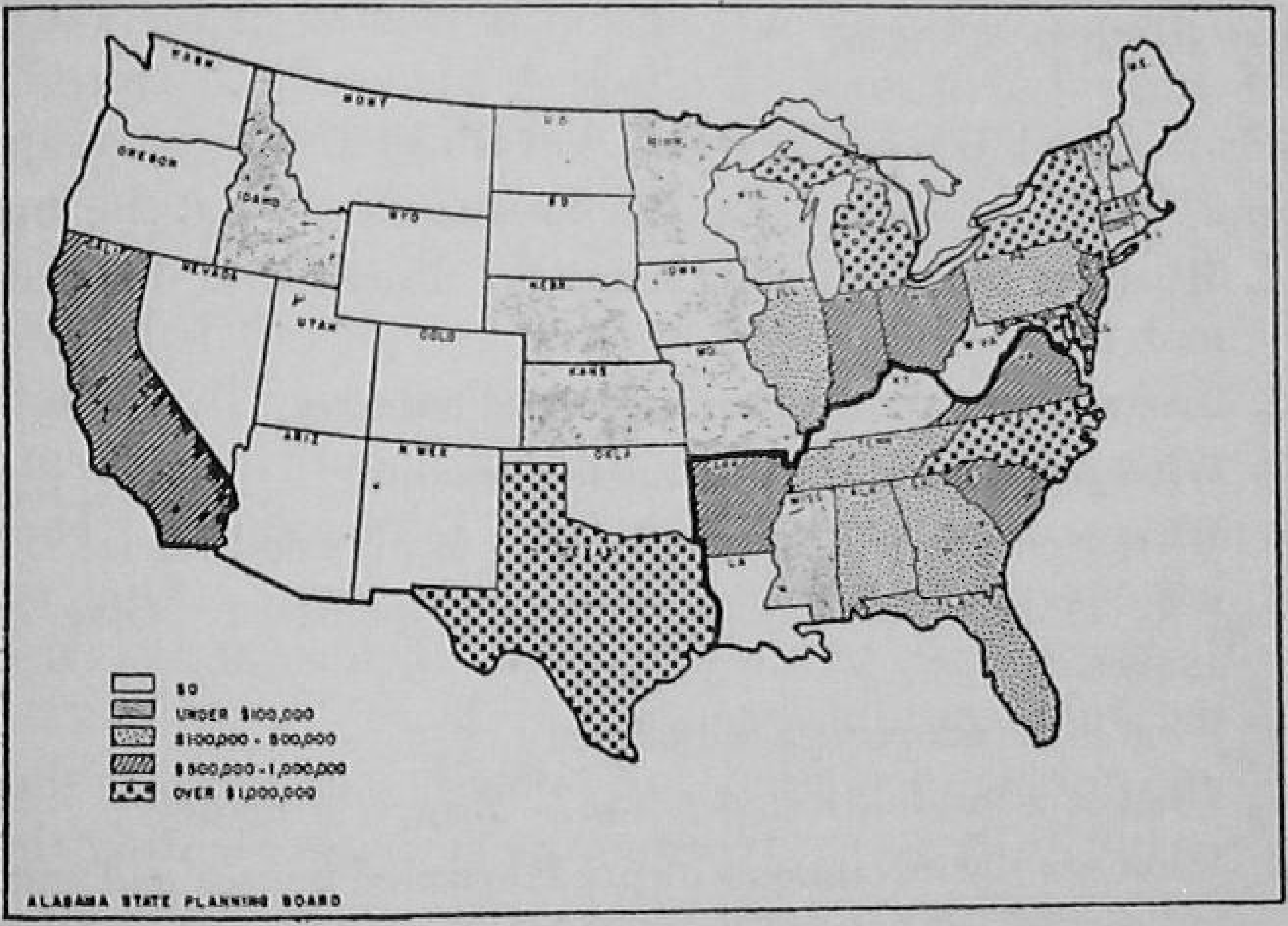
Pine posts when used for farm fences have a short life. But if they are creosote-treated before setting they will serve for a long period of years. In many states community fence post treating plants are operated by vocational departments in high schools, or by some organized group. This is a valuable community service.

Home and Rural Industries.—Wood and forest products lend themselves to a variety of uses in the establishment and operation of home or small-scale rural industries. Of this great group, the following are merely examples:

Basket Making. Tourists like to buy baskets, especially baskets with attractive color designs. This has led to basket-making in many rural homes.

Tool Making. Handle making is an important wood

industry. Handles must be made for rakes, hoes, shovels, and other tools. These handles can be made cheapest in factories; but they may be "turned" in home shops. In some communities, home workers buy handles and also the tool parts for which they are designed, and put the two together. This is "busy work" that fits into some home work schedules.



Plants Making Fruit and Vegetable Baskets

Bowl Making. Wooden salad, and mixing bowls are useful and popular. This is one home industry job that appeals to some men who like to work with power-operated tools. Bowl making is a forest or wood industry that may be conducted on a small scale.

Bat Making. The making of baseball bats is a wood industry. There are in the South a number of bat-making plants—in Alabama, Georgia, and Kentucky, for example. But, in addition, some bats and other sports equipment is made in home shops.

In Arkansas there is a factory that makes excellent bows and arrows. This is a fine art. Sales possibilities are very great on a national scale as archery becomes a popular sport and physical education activity and as actual hunting with bows and arrows increases as an appealing recreation.

There are many forestry industries of increasing economic importance. Vast timber resources are necessary to support them.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the wood-using industries discussed in this chapter?
2. Give an example of a chemical wood industry.
3. What are some of the uses made of rayon?
4. What is veneer? Plywood? How is plywood made?
5. Why is box making an important industry? Give examples.
6. What is the cooperage industry?
7. What is a pre-fabricated house? How is it made?
8. What are the advantages of pre-fabricated houses and small buildings? What are the disadvantages, if any?
9. What is meant by wood preservation? Give an example.
10. Discuss home and rural industries based upon the use of wood and forest products.

Selected References

Books

New Riches From the Soil, by Wheeler McMillen, D. Van Nostrand Co., New York, N. Y.

Other Publications

Southern Blue Book of Progress, Published annually by the Manufacturers Record, Baltimore, Md.

Suggested Activities

1. Make an industrial survey of your community for the pur-

pose of listing all forest and wood-using industries. What does each make? Where do they get their raw materials?

2. Make a survey to discover what home industries, if any, based upon the use of wood and forest products are conducted in your community. Tell how each is conducted.
3. From the list of industries developed in connection with the first activity, plan a visit to one or more industrial plants. Write a report of your visit.
4. Are there pre-fabricated houses or buildings in your community? If so, plan to visit such a home or building and find out what you think of the building from the standpoints of use and appearance. Also, secure the owner's impressions of factory-built structures and compare with those erected in the usual way.

UNIT IV—FOREST TREES

CHAPTER 12

HOW TREES GROW

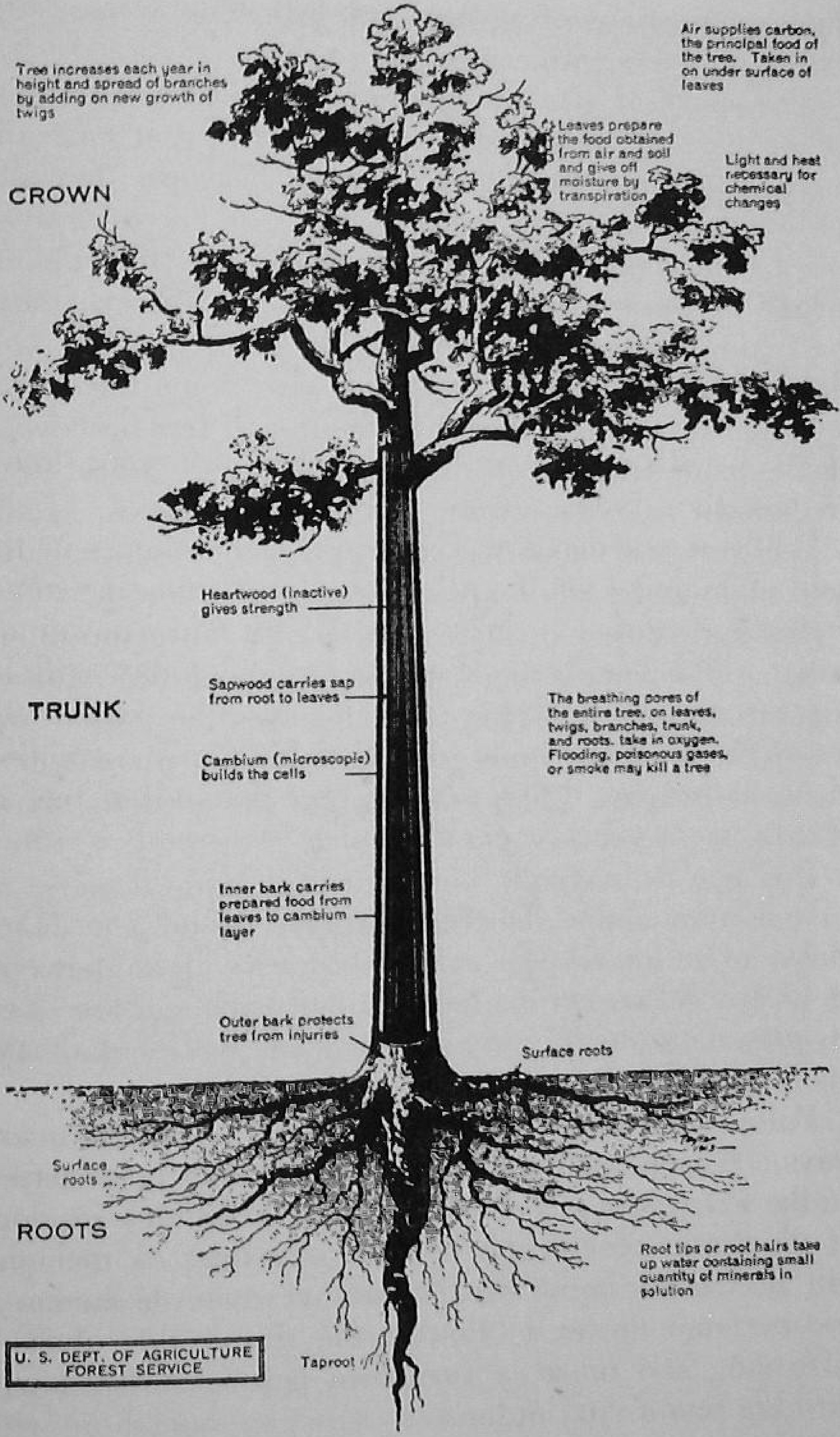
TO WORK with trees successfully, we must know how they grow.

While scientists have discovered many things in the field of biology, yet the growth of plants remains something of a miracle. Who can tell by what power an acorn which has dropped to the ground today will be a massive tree thirty years hence? Who knows the secret of how a tiny pine seed, weighing only a fraction of an ounce, can develop into a tree a hundred feet in height, containing enough lumber to build a small house?

In a general way, however, we understand *what* takes place, even though we cannot tell *why* it happens in the peculiar manner characteristic of each species. Yet, in spite of limited knowledge, the study of *life* is always interesting.

Most Trees Grow from Seeds.—Not all trees are produced from seeds. Some, like the white, or paper mulberry, grow from shoots. Others, like the pink dogwood, are the results of man-made propagation methods. But most trees, including the oak, the pine, the hickory, and persimmon, grow from seeds.

In the study of how trees grow, it is logical to begin with the seed. So, let us study an oak—beginning with


Tree increases each year in height and spread of branches by adding on new growth of twigs
Air supplies carbon, the principal food of the tree. Taken in on under surface of leaves
Leaves prepare the food obtained from air and soil and give off moisture by transpiration
CROWN
Light and heat necessary for chemical changes
Heartwood (inactive) gives strength
Sapwood carries sap from root to leaves
TRUNK
The breathing pores of the entire tree, on leaves, twigs, branches, trunk, and roots, take in oxygen. Flooding, poisonous gases, or smoke may kill a tree
Cambium (microscopic) builds the cells
Inner bark carries prepared food from leaves to cambium layer
Outer bark protects tree from injuries
Surface roots
Surface roots
ROOTS
Root tips or root hairs take up water containing small quantity of minerals in solution
U. S. DEPT. OF AGRICULTURE FOREST SERVICE
Taproot

the tiny particle of pollen and following it until we finally have a magnificent forest giant.

The spark of life which produces an acorn is found in the base of an oak flower. You may not have observed that oak trees have flowers, because they are not fragrant and are inconspicuous except to trained eyes. But trees do have flowers and most trees belong to one of three groups. Some, like the sumach, have the male and female flowers on different plants. This class of trees is known as *dioecious*. Some trees, like the alder or the oak, have both male and female flowers on the same tree but in different clusters. These trees are known as *monoecious*. Other tree species, as the wild cherry and magnolia, grow perfect flowers, in which both male and female are present in one flower.

The male flower or male portion of a flower produces pollen. The female flower or the female part of a flower contains the pistil. This pistil receives the pollen and passes it down the long green tube to the place where the seed is born. The pollen gives the seed its spark of life.

Did you ever shake the catkins, or male flowers, of an oak tree and watch the particles of pollen, which look like yellow dust, float into the air? These particles of pollen collect on the head of the pistil and, in some mysterious manner, are passed down the stem of the pistil to the cradle of the acorn.

Pollen is transferred to the female flower in many ways. Sometimes by the wind. Sometimes it is carried on the hairy legs of bees who search the hidden recesses of the flowers for nectar honey; sometimes on the long bill of the humming bird. But by whatever means it passes from flower to flower, the tiny yellow dust is lifegiving and must be furnished before the seed will develop into a vital organ.

Courtesy Southern Region U. S. Forest Service

More Than 300 Years Old

Did you know that there are living trees in the United States older than our nation? This one, which grew in Mississippi, was more than 300 years old when cut. It was growing, in 1606, when John Smith established the first American colony at Jamestown. At that time it was one year old. When the Battle of New Orleans was fought, it was two hundred years old. The age of any tree may be determined by counting the annual growth rings. Each ring indicates the growth made in one year

When the flower is gone and the pistil has withered and fallen off, the seed appears. Seeds occur in many forms and in many different kinds of coats, each characteristic of the tree which has given it birth. Pines have prickly burs; the buckeye has a hard, tough shell;

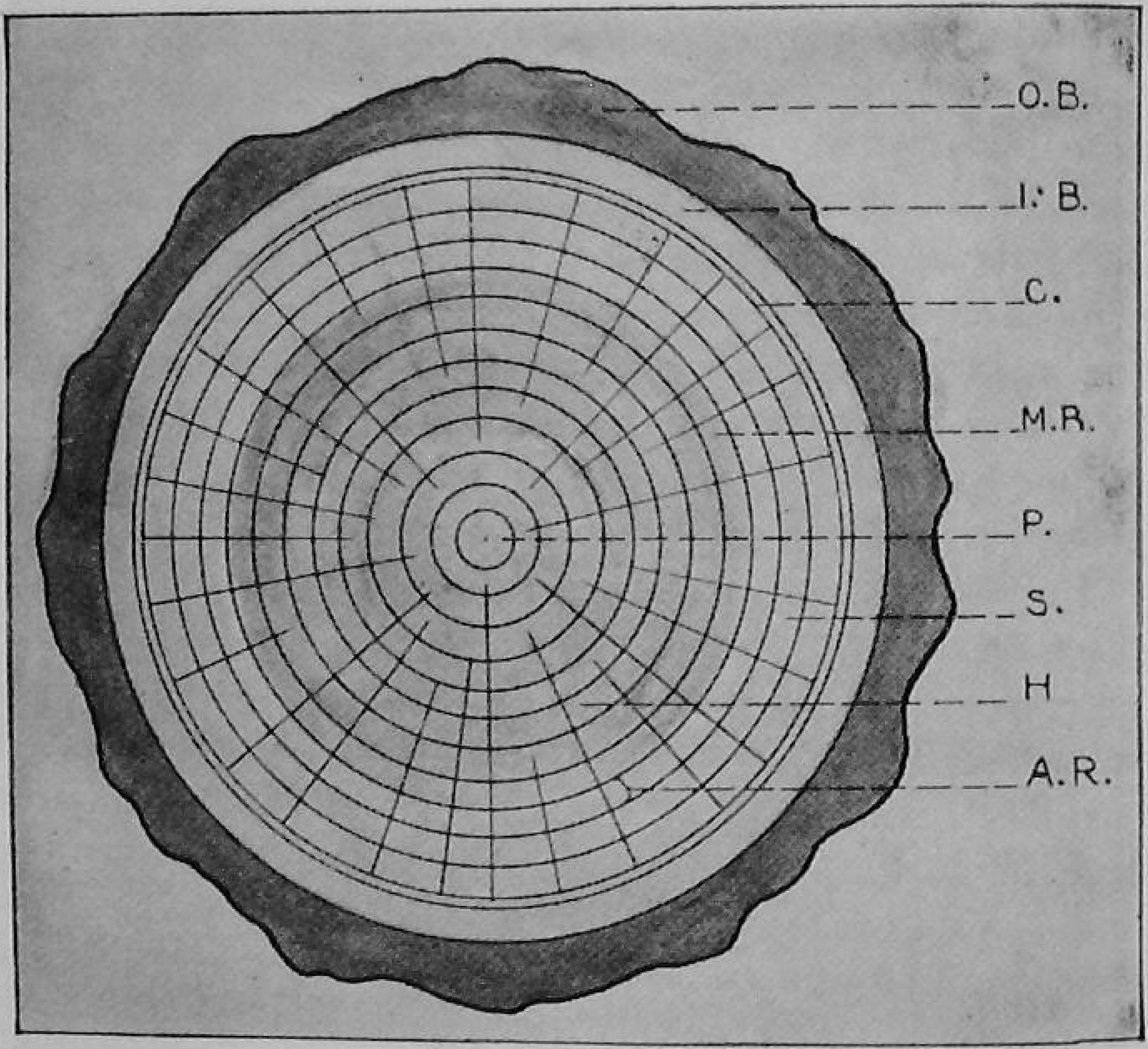


Diagram of Cross-Section of a Tree

O. B.—Outer Bark, a protective covering
I. B.—Inner Bark, which is soft and spongy
C.—Cambium, the growing part of the tree
M. R.—Medullary Rays, which transfer food horizontally
P.—Pith, a spongy tissue found in the center of the trunk
S.—Sapwood, conducts water and food from roots to leaves
H.—Heartwood, which is inactive but gives strength
A. R.—Annual Ring, a layer of light and dark wood forming one season's growth. The lighter and more porus portion is formed in the spring, and the darker more compact portion is formed in the summer

the wild cherry and persimmon seeds are protected by a bitter acid until the seeds are mature enough to carry on the spark of life.

Seeds and their coats are known by various names. Naturalists call the wild black cherry a *drupe,* and the persimmon a *juicy berry.* The seeds of the apple are contained in a *pulpy or fleshy fruit* and the ash and maple have *samaras.* The mulberry is called an *aggregate* fruit because of its cluster of edible tidbits. The seed of the oak tree is known as a *nut.*

Seeds of some trees are developed in one year and some are developed over a longer period. In the oaks, for instance, there is a variation in the amount of time in which acorns mature. White oak seeds become ripe in one season. In the group known as the black oak group, two years are required for the acorns to mature.

But when the seeds have finally become ripe and the mother oak is ready to release them—to place them in competition with the other trees of the forest, she releases them in large numbers, for only a few will survive. Some will be eaten by the birds and squirrels and deer of the forest. Some will fall on barren soil and soon lose their viability. The worms will eat the kernels out of many. Fire will destroy those dropped in woods that are burned.

How Seeds Are Scattered.—Seeds are scattered in various ways. Those from the oak on the hill will bounce and roll to the bottom. A bluejay will carry one across many hills and bury it in his favorite cache and then promptly proceed to forget where it was placed. The oak tree growing by the river shore will drop its acorns into the water and they will be carried many miles down stream to find a resting place on some far river bank. Some will fall under the trees and sprout where they roll into the leaves.

Not all seeds are distributed like those of the oak. Seeds of the pine and maple and willow use the winds as distributing agents. When such seeds are released, they drift with the air currents and sometimes travel for surprising distances. Toss up a handful of pine seed and see how they float gently earthward with a whirling motion. See how easily the willow seed will climb on the invisible planes of the wind and how they will float on water. Most trees growing on the river bank produce seed which will float. One interesting exception to this is the seed of the mangrove tree. It sprouts while it is still on the tree. When the seed drops from the branch, the feathered plumule holds it upright like a tiny arrow. It sticks into the mud with the foliage up and the root system down and begins to grow. Nature has developed this method for the preser-

How Old Is This Tree?

The young man with the increment borer will soon be able to learn the age of this tree by counting the number of annual rings

Courtesy Southern Region U. S. Forest Service

A Hardwood Nursery

Four months old Black Locust

vation of the species. Other types of seeds, like the wild cherry and red mulberry are contained in delicious morsels. This type of seed is distributed by birds and animals.

Let us pause for a moment to study the construction of an acorn in order that we may better understand how it grows. Scientists have divided the seed into many parts but the main parts are the *plumule,* or growing portion, and the *cotyledons,* or that portion which produces food for the growing plumule until it can find food of its own in the earth.

An interesting fact is that no matter what position the acorn occupies in the ground, the plumule or growing portion always turns and grows toward the heavens and its roots always grow into the earth. Science has attempted to explain the miracle, but the truth is that some power, unknown to man, directs this reversal of position which we have come to regard as casual.

An Acorn Becomes a Tree.—And so this tiny embryo becomes a living tree of the forest. It may or

may not survive, for it has many enemies. One great enemy to the young tree is shade. Nature has devised certain means of overcoming this first enemy of the seedling. Look about you in the forest sometimes and you will find a young plant with leaves many times larger than those found on the parent tree. These leaves, growing close to the floor of the forest, are exceptionally large in order that they may catch all the sunlight which filters through the forest canopy of cover overhead. The plant must have sunlight in order that the normal functions of the leaf will be carried on. Without that sunlight the leaf and the small plant will die.

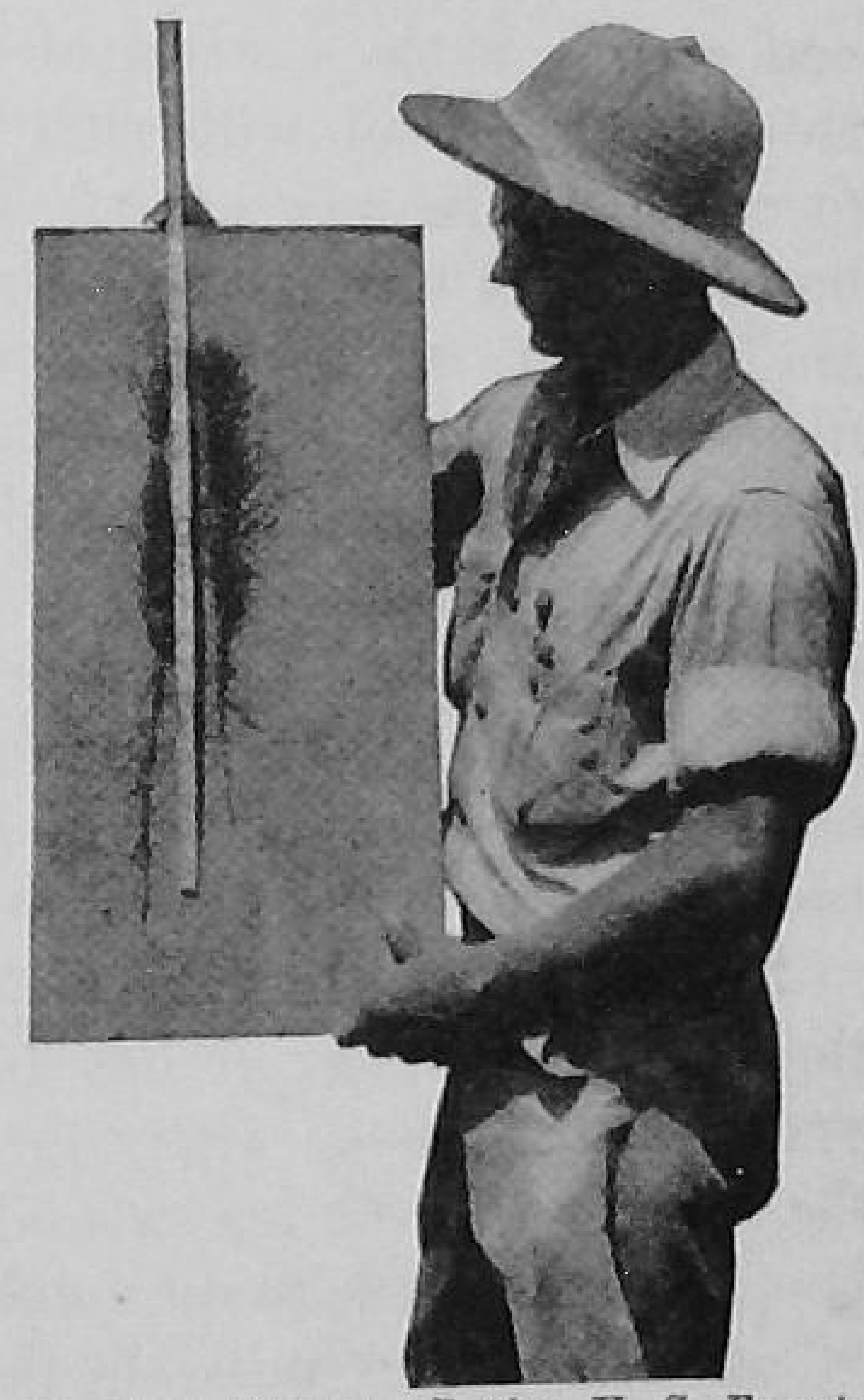
Unlike leaves of the hardwoods, the pine leaf, which is long and needle-like, never changes its size and shape, even from a seedling. It is found in the open glades of the forest. It responds quickly and surely to the touch of the sun and grows faster than hardwoods. Because of the size of its leaves, it will die under shade more quickly than the broadleaf species. For this reason pines are known as *intolerant* trees and hardwoods are generally classed as *tolerant* trees because they will stand more shade.

Years have passed and our acorn, born at the base of a flower, dropped to the forest floor, and nurtured against the warm earth, has fought for its existence with the other trees around it and finally has become a monarch in its own right. Its crown covers a huge space in the forest canopy and its root system under the ground covers just as much space as the crown covers above the earth. So from a simple acorn, with its plumule and cotyledons, has come a complex and wonderful plant.

Function of Tree Parts.—Let us examine this complex plant to see what makes it grow. It may not prove so complex, after all. The tree has three main parts—

roots, trunk, and crown—each with definite functions. Perhaps it would be most interesting to begin far under ground with the root system and examine the functions of each tree part to see what role it has played in building this magnificent giant of the forest.

The Function of Roots.—Roots have a two-fold purpose. One of which is that they act as an anchor to hold the tree in the ground to keep it upright. Where a tree stands alone in the field, exposed to the wind, its roots penetrate deep into the earth. A tree which stands on the edge of the forest, protecting the other trees, also has heavy deep-growing roots. A tree within the forest, where the competition is keen for every drop of water falling on the forest floor, turns its roots back toward the surface of the ground, and consequently has a shallow root system. Cut down those trees on the edge of the forest and the next wind storm will uproot the ones which have been protected inside.



Courtesy Southern Region U. S. Forest Service

ONE YEAR OLD

Longleaf (left) and slash pine seedlings taken from the nursery

The second purpose of the root system is to secure food materials and water from the ground and pass it on up the trunk to the leaves, or stomach of the tree.

These food-seeking roots, which penetrate the earth, searching for mineral food material, grow on the extreme end of the heavy support roots. They are sometimes known as *root hairs* because of their size.

Tree roots are accurate in locating the source of food materials in the soil.

A few years ago a southern farmer prepared a flower bed among a thick stand of pines located in his yard. He filled the beds with rich woods earth and fertilizer to make the flowers grow. The growth of the flowers, however, was not as vigorous as he had expected. No amount of fertilizer seemed to stimulate the growth of the flowers. His plants were on the verge of dying when he removed them to locate the source of trouble. He found that the pine trees, in competition with the roots of his flowers, had filled every bed with a mass of tiny pine roots and were choking out the flowers. It was necessary to pour a layer of concrete around the flower beds to keep out the pine roots.

Function of the Trunk.—After the mineral solution of food material has been gathered by the root system, it is passed along the larger roots and through the sapwood to the leaves and there combined with carbon from the air to make food for the tree. The process of osmosis makes possible this movement. *Osmosis* is the absorption of water from cell to cell. A string hung in a bucket of water will become saturated above the water line. A drop of water on a spoon of sugar will saturate the entire mass. That is osmosis. But not on such a scale as a tree absorbs food material and water, which in certain species is sent many hundreds of feet into the air, higher than water can be pumped by the most powerful machinery.

Between the bark and sapwood is found the *cambium layer*. It is a spongy tissue that builds the cells, thus

causing the tree trunk and limbs to increase in diameter. A tree does not grow up from its base, as many people believe, but from its tips outward. Ask the average person this question: "How high will a nail driven at the base of a tree be above the ground in ten years?" You will receive all kinds of answers from four to

Courtesy Southern Region U. S. Forest Service

ONE YEAR'S GROWTH

The young man in this picture is indicating how much the pine tree has grown in one year

twenty feet. None of them is correct. The nail will remain at the base of the tree and be enveloped by growth rings built by the cambium layer.

The Leaves Are Factories.—The leaves are the factories of the tree. They take the raw materials brought from the roots and, with the aid of air and sunshine, make the food required for growth. Leaves absorb carbon dioxide, a gas poisonous to human lungs, and with the water and minerals which have been supplied from the earth through the sapwood, the mixture is

broken down into carbon, hydrogen, and oxygen. The oxygen, so vital to human beings, is given off as a waste product from the tree and the other elements are made into starches and sugars and food materials for the tree itself. Experiments have been conducted to show that during the summer months a fair-sized tree on a hot summer day will give off approximately sixty gallons of water into the air.

The assimilation of food material in the leaves is called *photosynthesis,* which is a Greek word that means "building up by use of light." The process of making tree food can go on only in the presence of sunlight. It is interesting to note that a tree grows twice as much at night as it does during the daylight hours. After the food has been manufactured in the leaves, it is carried by way of the inner bark to the cambium layer in all parts of the tree. Thus the food obtained from the air and soil and prepared by the leaves is used to feed the tree and make it grow.

The bark on the outside of the tree, known as the outer bark, is for the protection of the cambium layer, or growing tissue. Most trees have tough, durable bark which acts as protection against mechanical injury and against the ravages of insects. The bark is not impervious, however, and when it has been weakened by lack of food or water or sunlight a tree quickly succumbs to destruction by insects or disease.

The softer wood, or sapwood, immediately beneath the cambium layer, carries the water and soluble food material up the tree to the leaves. As this wood becomes hardened and useless for the purpose of conducting sap, it becomes heartwood. Heartwood serves the purpose of support and is the backbone of the tree. Commercially it is the most valuable section of the tree,

and brings a higher price for lumber than does sapwood.

Rings Show Age of Trees.—The age of a tree may be determined by the number of growth rings on the stump or at the base of the tree. To tell the age of a tree without cutting it down, foresters use an instrument known as an *increment borer*. With this instrument they bore into the heart of the tree and remove a core which is a cross-section of the life of the tree from the bark to the exact center of the heartwood. The number of rings shown on this core will tell the exact age.

These rings are formed by two distinct kinds of wood cells. Each spring the growth of the tree is vigorous and the cells of the wood are soft and large. Study has shown that at least three-fourths of the growth of a tree is made during the first few weeks of spring. The summer growth may contain just as many cells, but they are much smaller, and the difference between the two types of growth may be seen with the naked eye. The tree does not grow at all during the winter months when the leaves are off. This period is commonly known as the time "when the sap is down." The big fat cells and the hard, tight wood are so different in appearance that they have the semblance of rings, and since these rings are formed each spring and summer, the age of a tree may be told by counting them. One ring is formed each year. A fast-growing tree will have much thicker rings than a tree which grows more slowly. Thick rings sometimes occur during wet years.

Thus in the development of a forest giant, such as an oak, there has occurred the miracle of miracles. It began with a grain of pollen—its spark of life. It sprouted. It battled its way with the other trees for its rightful place among the other giants of the forest. It

took its food from the earth and from the air, in competition with the other trees around it. It clung tenaciously to life. One day it will become old and die, just as all living things die. But in the process of living and dying, it will produce many thousands of its kind, all of which will go through the same process in the struggle for existence.

SUGGESTIONS FOR STUDY

Questions and Problems

1. By what methods are trees produced? Which method is most common?
2. Explain what is meant by *dioecious* trees. By *monoecious* trees.
3. What kind of flower or part of flower produces pollen? What part of the flower contains the pistil? Name several ways pollen is transferred to the female flower. Can you explain how seeds are formed?
4. How are tree seeds protected until mature? What happens to the great majority of the seeds?
5. Name four ways that tree seeds are distributed.
6. Why is shade one of the greatest enemies to young trees? What is meant by tolerant and intolerant trees?
7. Name the three main parts of a tree. What are the principal functions of the roots of a tree?
8. Explain how water is carried from the roots of a tree to the leaves. What is meant by *osmosis?*
9. What is the function of the cambium layer? Where is it located? Explain the manner in which trees grow.
10. What part do leaves play in the growth of a tree? What is the meaning of the word photosynthesis? What is the principal tree food taken from air? What element is given off by leaves? What is the function of the inner bark?

11. What part does the outer bark serve in the growth of a tree? The sapwood? The heartwood?
12. How do foresters determine the age of a tree without cutting it down? Tell how growth rings are formed. How often is a ring formed?

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Harwood, W. S., New Creations in Plant Life, The Macmillan Co., Atlanta.

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Suggested Activities

1. Make a collection of tree seeds to be found in the community. Bring them to school and hold an identification contest to see how many each member of the class can identify.
2. Cut cross sections from a number of trees for the purpose of studying the annual growth rings. Determine how old a tree is from the growth rings.
3. To determine the variations in the rate of growth cut a cross section from a tree in a forest that has been thinned and compare it with a cross section taken from an area where the trees grew close together.
4. Make a study of *osmosis* in the ways suggested in this chapter and in any other ways that may be suggested in your General Science text.
5. Make a list of all the words in this chapter which are new to you; that is, words which you do not have in your speaking vocabulary. Look up the definition of each

word in the dictionary, as well as the pronunciation, and discuss these words in class.

6. Bring in a cross section of a branch of a tree and examine the cambium layer and the other parts mentioned in the text.
7. It is suggested that not all trees are propagated from seeds. What trees start in some other way? Explain how we get Pink Dogwoods.
8. Make a study of the flower of any plant to see if you can find the different parts of the flower given in the text?
9. Place a glass jar over the top of a growing plant and place it in the sunlight to see if moisture condenses on the inside of the jar. Where does this water come from?
10. Make a study of the "job" of collecting seeds for growing forest seedlings. Where do the forest nurseries get their seeds? When are they gathered? How are they stored? When are the seeds planted? How much do nurseries pay for seeds?

CHAPTER 13

IDENTIFYING TREES

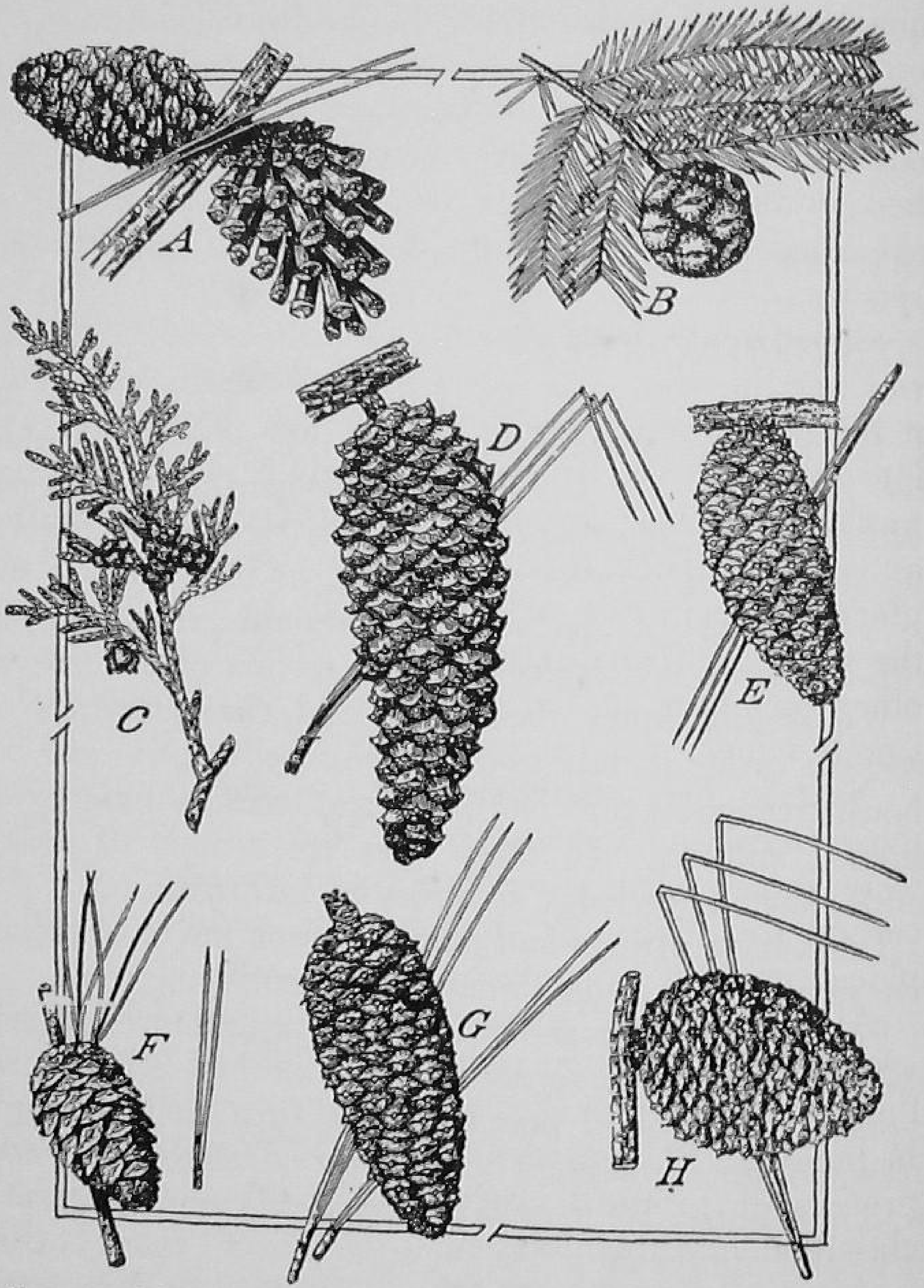
LET'S *Know Some Trees* is the title of a publication issued by the United States Department of Agriculture, which describes some of the trees of California. But it is given here as a challenge, or invitation, to the boys and girls of the South who should get acquainted with the trees which grow in this section of the nation.

We should know the names and characteristics of trees in order to talk about them intelligently, and we should recognize the common forest trees as a matter of general culture. To those who are owners of forest lands, such knowledge is essential information.

Trees have always had names. Even the most primitive savages have some method of identifying trees.

Perhaps six thousand years ago, the untutored hunter had a very limited vocabulary, but he had a keen perception. He found one tree that furnished excellent firewood, good weapons in the form of tough clubs, and delicious nuts. He may have named this the "Womphut," or tree of many uses. He knew the tree of "bitter bark," or the tree of "large white flowers." So even then, trees had names.

Today, each of the many thousands of trees has a name by which it is known. In fact, every tree has two names. One of these is the *common name* by which it is generally known. But it also has a *scientific* or *botanical name* by which it is scientifically classified by



Cones and leaves of conifers of the Southern region; *A.* Spruce pine; *B.* cypress; *C.* white cedar; *D.* longleaf pine; *E.* loblolly pine; *F.* shortleaf pine; *G.* slash pine; *H.* pond pine

botanists, foresters, and other men with scientific training. The scientific name, which is the Latin, is more exact than the common name; it conveys, to one ac-

quainted with such names, more specific and accurate information.

In 1753, a scientist by the name of *Linnaeus* worked out a plan by which each tree could be properly classified in the plant world. He did even more, for he classified them according to *families*, *genera*, and *species*.

Classification of Trees.—The tree with long, narrow needles, Linnaeus placed in one family and called it the pine family. This family was then sub-divided into genera. All trees, for example, where the seed was contained in a round, fleshy berry, were classified as cedars. They had other characteristics too, which placed them in this generic group. But the seeds were the main distinguishing feature, since the seeds of all other members of the pine family were contained in woody cones.

Next in his sub-division of the pine family, came those trees which shed their needles each year. These were sub-divided into larches and cypress, each with certain distinguishing characteristics of its own, which placed each in a separate genera.

All the remaining trees in this family had needles which remained green throughout the winter. Next, there were many trees which had their needles clustered in bundles. These Linnaeus called pines. By such a process of grouped characteristics, all the trees were classified into distinct genera.

After all the trees in the pine family were properly classified according to the genera, Linnaeus set about subdividing the genera into species.

The pines which contained more than five needles in one bundle, he called white pines. And he established the white pine group for all the different species of white pines. Because the wood is so soft, this group

is often known as the soft pines, and all other representatives of this genera are known as hard pines.

In the hard pine group, the tree with needles twelve to fifteen inches in length, clustered at the ends of the twigs, forming a rounded head, with cones six to twelve inches long, slightly curved and armed with prickles was named *Pinus Palustris*, or *longleaf pine*. The first is the scientific name; the second the common name.

Another species which contained two very short needles to the bundle, which had prickly cones less than two inches in length, and other distinguishing characteristics, he named *Pinus echinata*, or *shortleaf*, or *shortleaf yellow pine.*

In this manner, each species was classified according to the characteristics which distinguished it from the remainder of the trees in its family and its genera. So we may show this relationship in the outline below, which includes only a few of the more important southern members of the pine family.

THE PINE FAMILY

Genera	*Species*
Cypress (Taxiodium)	Southern Cypress (Taxodium Distichum) Pond Cypress (Taxodium Ascendens)
Hemlock (Tsugh)	Eastern Hemlock (Tsuga Canadensis) Carolina Hemlock (Tsuga Caroliniana)
Cedar (Juniperus)	Southern Red Cedar (Juniperus Lucayana) Eastern Red Cedar (Juniperus Virginiana)

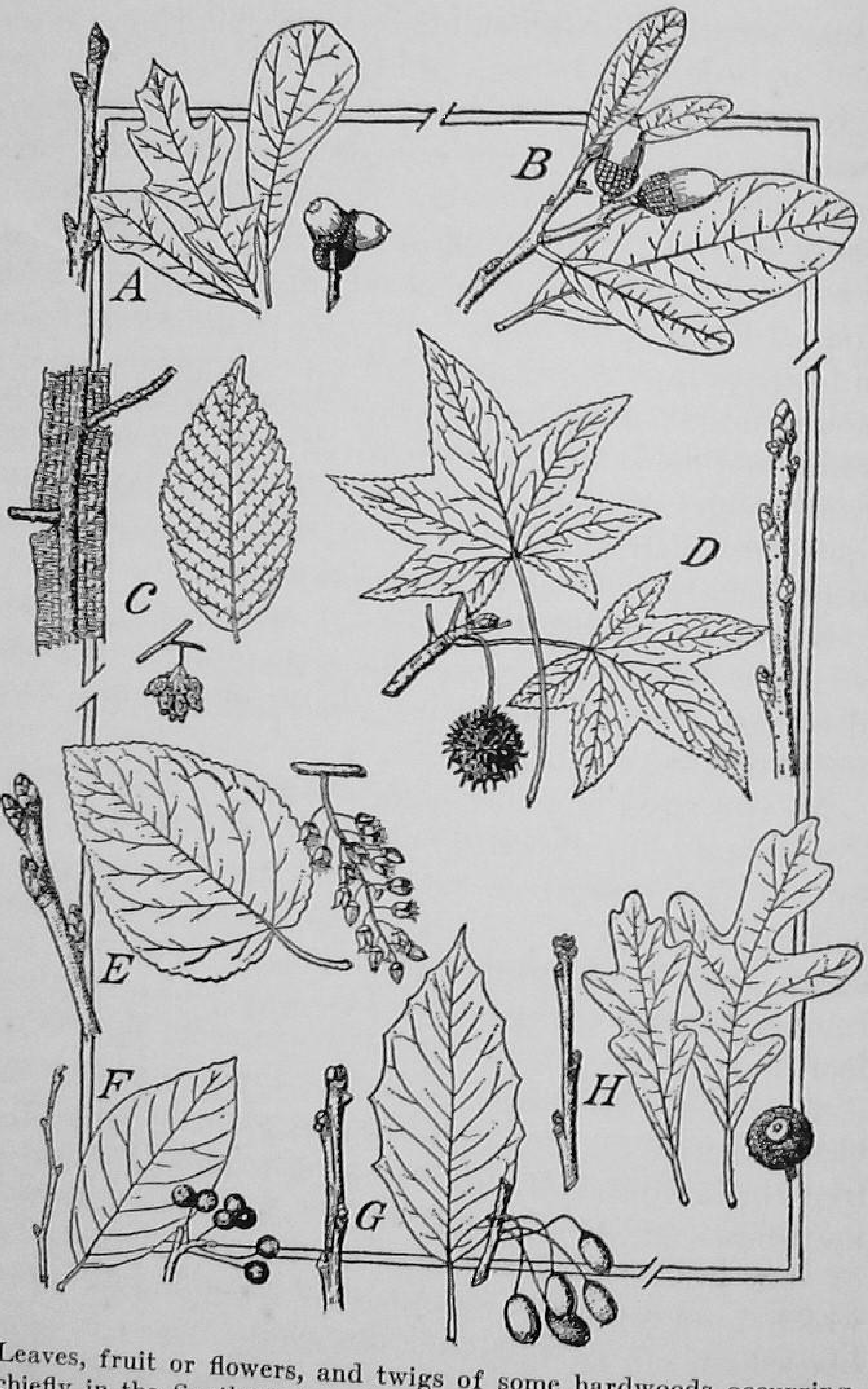
Pine (Pinus)	Longleaf Pine (Pinus Palustris) Shortleaf Pine (Pinus Echinata) Slash Pine (Pinus Caribaea) Loblolly Pine (Pinus Taeda)

These Latin names all have a definite meaning. All are descriptive. For example, *Magnolia Grandiflora* means the magnolia with large flowers. Each name means something. A very interesting example is that of *Roystonia Regia.* This is the scientific name of the royal palm, which grows in Florida and in some sections along the Gulf Coast. The name is derived from that of General Roy Stone, and the Latin word regia, which means royal.

The reason that Linnaeus used Latin in the classification of trees and plants was because, at that time, Latin was the language of scholars.

While few persons will learn the Latin names of many trees, it is a matter of general interest to know how trees were named and classified. This general knowledge is essential too in many ways, for example, in ordering plants and shrubs for our lawns from a commercial nursery, or even tree seedlings, we may find that if we do not know the plant by the scientific name we may get a relative, but not the member of the family in which we are interested. Let us give an example! *Cornus Florida* is the white flowering dogwood, but *Cornus Florida var. ruba* is the pink dogwood.

One who works with trees and shrubs will soon learn the Latin names. It is quite as easy as to learn the names of one's classmates at school. So even though



Leaves, fruit or flowers, and twigs of some hardwoods occurring chiefly in the Southern forest region; *A*, water oak; *B*, live oak; *C*, winged elm; *D*, sweet, or red gum; *E*, swamp cottonwood; *F*, swamp black gum; *G*, tupelo gum; *H*, overcup oak

it may seem a little difficult to retain so many new words, they, in time, may become old friends.

Knowing Trees by Habitat.—A study of trees will lead one to discover very quickly that each kind has a somewhat limited habitat. This means the locality where it grows. The white birch is a tree of the North Woods; the longleaf pine grows almost entirely in the Coastal Plain of the South. Willows or alders are found in low, swampy places, close to water; the chestnut and mountain oak grow only on high, rocky hillsides. One would not look for cypress at the top of a mountain. Each species of tree has some geographic location which limits its distribution. And each has some environmental characteristics which it prefers.

Knowing Trees by Leaves.—We may know trees by name and by the place where they grow. We may also know trees by the shape and color, and other characteristics, of the leaves.

No two trees have leaves just exactly alike.

The holly has leathery, bright green leaves with sharp spines. The sweetgum has five-pointed, or star-shaped leaves. The bay has a heavy leaf which is light green above and silvery on its under-surface. The ash has a compound leaf, with from five to nine leaflets along the leaf stem.

Leaves are arranged in many different ways, each characteristic of the species on which it grows. Most trees have simple leaves which grow alternately along the branch or stem. The yellow poplar is an example of this arrangement. Other trees have simple leaves which grow opposite one another on the stem, as the black haw and the maples. The catalpa tree has simple leaves which grow in *whorls* of three on the stem. Some trees like the crab apple and the service berry, grow their leaves in clusters on the tip of the stem.

The character of the leaves themselves, as well as the arrangement, helps to identify them. Some trees have already been described. The white oak has a leaf which is called *obovate* because it is shaped like an egg, with the narrow end toward the stem. Tree students call the leaf of the elm *lanceolate*, because it is long and narrow and shaped like a lance. Leaves which are almost square on the end, as the yellow poplar, are said to have a *truncate apex* and leaves which are long and pointed on the end are called *acuminate*.

The margins or edges of leaves are very different. Leaves smooth on the margin, like the rhododendron, are called *entire*, and those with sharp teeth along the edge are known as *dentate* or *serrate*, according to the size of their indentations. Some leaves are *lobed*, some *incised* and some *doubly serrated*.

The types of leaf and bundle scars is another method of tree identification. Almost every tree has a different type of leaf scar, the scar which is left when the leaf drops off the tree in the fall of the year.

Knowing Trees by Flowers, Bark, and Twigs.—Flowers and seeds have been described in another chapter, but in the spring and summer flowers are recognized through certain means of identification.

The bark of trees is characteristic of the species when the student comes to know the different kinds of bark. Bark ranges in color from almost black, through the various shades of red, brown, green, yellow, and gray to almost white. Bark is also different in appearance. On the shell-bark hickory the bark occurs in long, loose scales, which are easily peeled from the tree trunk. The yellow poplar has a bark which is tight and smooth in a young tree and rigid in an old tree. On the sycamore tree the bark occurs in dark, loose scales which are small and which usually fall from the tree trunk,

Identify these leaves, twigs, fruits, and flowers

leaving the white, tight bark underneath, and giving the tree the appearance of being almost white. The red oak has bark which is marked with deep ridges, and the bark of the persimmon occurs in little gray squares.

Twigs and buds are another means of identification. The twigs may be large and smooth, or very small and wiry. They may be angular, with ridges or covered with bristly hairs or with scales. They may be very tough or brittle. They may have a distinct odor or taste. No two species have buds which are exactly alike. The buds may be in clusters, as in all the oaks, or embedded, as in the black locust. The beech has a long, terminal bud.

Trees may be identified by their wood. A lumber man, carpenter, or cabinetmaker can identify wood as coming from a certain species. Each is different. The cell structure varies widely. Some wood is soft, other wood is hard. All these things are important in the wood utilization industries. The peculiar characteristics determine the uses to which the tree is adapted.

There are many ways by which trees may be identified. We may learn to know them by name; by the place where they grow; by the shape, color, size, and arrangement of the leaves; by the bark; by the twigs and buds; and by their wood.

It is important to know the names of trees so that we may discuss them; it is essential to know where they grow in order that we may determine whether they are adapted to the place in which we live; it is necessary to be familiar with some of their distinguishing characteristics so that we may identify them.

For some of the southern forest trees valuable information is contained in the table from Miscellaneous Publication 217 of the U. S. Department of Agriculture which begins on page 267:

SOUTHERN FOREST TREES

Name of Tree	*Where the Tree Grows*	*Descriptive Notes*
Loblolly pine (Pinus taeda)	Southeastern States, coastal plain, Delaware to Texas.	Leaves 3 in cluster, 6 to 9 inches long. Cone 2 to 3 inches long, with stiff sharp prickles. Important timber tree.
Shortleaf pine (Pinus echinata)	Middle Atlantic and Southern States, New Jersey to Missouri, Louisiana, and Texas. Uplands.	Leaves 2 or 3 in clusters, 3 to 5 inches long. Cone small, about 2 inches long; fine prickle. Important timber tree.
Longleaf pine (Pinus palustris)	Coastal Plain, North Carolina to Texas.	Leaves 3 in cluster, 8 to 18 inches long. Cone prickly, 6 to 10 inches long. Important tree for timber and naval stores.
Slash pine (Pinus caribaea)	Coastal Plain, South Carolina, south and west to Louisiana.	Leaves 2 or 3 in cluster, 8 to 14 inches long. Cone shiny, 3 to 5 inches long. Important for timber and naval stores. Extensively planted.
Eastern hemlock (Tsuga canadensis)	Northeastern and Lake States, south to Ohio River, south in Appalachian Mountains.	Leaves ½ inch long, apparently in flat arrangement on stem, shiny green, lighter below. Timber tree; bark for tanning leather.
Southern Cypress (Taxodium distichum)	Atlantic Coastal Plain, Delaware to Texas, central Mississippi Basin.	Leaves ¾ inch long, feather arrangement, falling in autumn. Cone round, of hard scales. Timber tree.
Eastern red cedar (Juniperus virginiana)	Eastern half of United States.	Leaves scalelike, on young shoots awllike. Berries bluish, ripening in 1 season. Aromatic durable wood.

Name of Tree	*Where the Tree Grows*	*Descriptive Notes*
Black Walnut (Juglans nigra)	New York west to Iowa and southward	Leaves 12 to 24 inches long, of 15 to 23 leaflets. Nut round. Bark rich brown. Highgrade cabinet wood.
Pecan (Hicoria pecan)	Mississippi Valley, Iowa to Texas.	Leaves of 9 to 17 leaflets; bud scales few. Nut with thin brittle shell and sweet kernel. Many varieties grown on commercial scale throughout the South.
Bitternut hickory (Hicoria cordiformis)	Eastern United States to Great Plains.	Leaves of 7 to 9 long-pointed leaflets. Nut broad, thin-husked, with bitter kernel.
Shagbark hickory (scaly bark hickory) (Hicoria ovata)	Eastern United States (exclusive of southern coastal region).	Bark loosening in narrow strips. Leaves of 5 large leaflets. Nut thick-shelled, with sweet kernel.
Mockernut hickory (white or bigbud hickory) (Hicoria alba)	Southeastern quarter of United States and a little northward.	Winter buds large. Leaves broad, of 7 to 9 leaflets, strong-scented, hairy. Nut thick-shelled, small sweet kernel.
Pignut hickory (Hicoria glabra)	Vermont to Michigan and south in Appalachian Mountains and foothills.	Nut smooth, thick-shelled, sweet kernel, rounded or pear-shaped. Leaves of 5 pointed leaflets.
Eastern cottonwood (Carolina poplar) (Populus deltoides)	Eastern half of United States.	Leaves triangular, coarsely toothed, fragrant, with flattened stems. Buds resinous.
Black willow (Salix nigra)	Eastern half of United States, along streams, not in swamps.	Leaves slender, long-pointed, finely toothed. Branchlets reddish. Largest of the willows.
Hophornbeam (Ironwood) (Ostrya virginiana)	United States and Canada east of the Great Plains.	Thin brown scaly bark. Fruit resembling hops, each seed in bag. Leaves doubly toothed.

Name of Tree	Where the Tree Grows	Descriptive Notes
River birch (red birch) (Betula nigra)	Southern New England, west to Minnesota, south to Texas. Along streams.	Bark red-brown, peeling in tough layers. Leaves oval, 2 to 3 inches long, narrowed at base, doubly toothed.
Beech (Fagus grandifolia)	Eastern half of United States. A widely ranging tree.	Leaves toothed, flat, thin, firm. Triangular edible nuts.
Chestnut (Castanea dentata)	Northeastern States and Appalachian region to Florida.	Leaves long, coarsely toothed, pointed. Spiny bur with edible nuts. Trees mostly killed back by blight disease.
Scarlet oak (Quercus coccinea)	Northeastern United States. Maine to Missouri, mountains to Georgia.	Leaves with deep rounded sinuses, lobes pointed. Acorn large, often striped, in medium cup.
Northern red oak (Quercus borealis)	Northeastern quarter of United States, south in Appalachian Mountains and cool locations along streams. (Variety. Maxima important in southern Appalachian region.)	Acorn large, in flat shallow cup. Leaves mostly with 7 to 11 uniform lobes, 6 to 9 inches long, dull above, green below. High-grade timber tree. (Beginning the black oak group which has pointed leaf lobes and requires 2 seasons to mature the acorns.)
Black oak (Quercus velutina)	Eastern half of United States, except Lake States region.	Leaves mostly 7-lobed, the lower ones rather full, others more deeply lobed. Acorn deeply enclosed in scaly cup. Inner bark orange.
Southern red oak (Quercus rubra)	Southeastern United States. Abundant.	Leaves urn-shaped at base, with fingerlike lobes or a 3-pointed outer end. Acorn ½ inch long in flat cup. Important timber tree.

Name of Tree	*Where the Tree Grows*	*Descriptive Notes*
Blackjack oak (Quercus marilandica)	Eastern United States, except New England.	Leaves full, thick, dark green, shiny. Acorn small, in medium cup.
Water oak (Quercus nigra)	Southeastern United States.	Leaves nearly evergreen, oblong with narrowing base, not toothed, but sometimes 3-lobed. Acorn in small shallow cup.
Willow oak (Quercus phellos)	Atlantic and Gulf coastal region, New York to Texas.	Leaves narrow, willowlike, smooth, 2 to 5 inches long. Acorn small, striped lengthwise, in shallow cup.
Live oak (Quercus virginiana)	South Atlantic and Gulf coasts, Virginia to Texas.	Leaves oblong, edges smooth but incurved, thick, pale, fuzzy below, evergreen. Bark grayish. Acorn borne on long stem (peduncle). (Beginning the white oak group whose leaf lobes are rounded and whose acorns mature in 1 season.)
White oak (forked-leaf white oak) (Quercus alba)	Eastern half of United States.	Leaves deeply and wavy lobed. Acorn in low flat cup. Important timber tree.
Post oak (Quercus stellata)	Central and southern United States, Massachusetts to Texas.	Leaves like Maltese cross, thick, leathery, woolly below. Acorn close to branchlet, in deep cup.
Overcup oak (Quercus lyrata)	Atlantic and Gulf coasts, New Jersey to Texas. Near water.	Leaves narrow with shallow lobes; acorn nearly enclosed in fringed cup.
Chestnut oak (rock oak) (Quercus montana)	Northeastern and central United States.	Leaves coarsely notched. Acorn large, shiny, in warty cup. Bark extensively used for tanning leather.

Name of Tree	*Where the Tree Grows*	*Descriptive Notes*
American elm (white elm) (Ulmus americana)	Eastern half of United States east of the Great Plains.	Leaves doubly and sharply toothed, smooth above. Wings of seed with tiny hairs. Large tree with drooping branches. Extensively planted.
Winged elm (wahoo) (Ulmus alata)	Southeastern quarter of United States.	Leaves small, variable in size. Seeds winged, hairy. Young twigs often corky. Planted for shade and ornament in South.
Slippery elm (Ulmus fulva)	Eastern United States.	Leaves rough, hairy above, soft downy below. Winged seeds, not hairy on edges. Inner bark muscilagenous.
Hackberry (Celtis pumila georgiana)	Central part of southeastern United States.	Leaves 2 inches long, thin, rough above. Fruit red-purple with bloom.
Evergreen magnolia (Magnolia grandiflora)	South Atlantic and Gulf coasts (widely planted for ornament)	Leaves thick, glossy, 5 to 8 inches long, evergreen. Fruit, head of many bright red seeds. Flowers large, white.
Sweet bay (Magnolia virginiana)	Coastal region, Massachusetts to Florida and Texas.	Leaves oblong, pale green, whitish below. Seeds scarlet. Flowers white, sweet.
Yellow poplar (tulip poplar), (tuliptree) (Liriodendron tulipifera)	Southern New England to Michigan and Southern States.	Leaves squared, with lobe on sides. Flowers greenish-yellow, tulip shaped. Fruit a cone of winged seed. Important timber tree.
Sweet gum or red gum (Liquidambar styraciflua)	Southeastern quarter of United States.	Leaves star-shaped, aromatic. Fruit a spiny ball of many capsules with seeds. Large tree. Important timber tree.

Name of Tree	*Where the Tree Grows*	*Descriptive Notes*
Sycamore (Platanus occidentalis)	Eastern half of United States. Moist or cool locations.	Bark gray, flaking off. Leaves large, broad, lobed. Balls single, hanging by slender stem over winter. Largest of all hardwood trees—up to 10 feet in diameter and 170 feet in height.
Service berry (shadbush) (Amelanchier canadensis)	Eastern half of United States.	Flowers white, appearing before the leaves. Leaves thin, oval, finely toothed.
Black cherry (Prunus serotina)	Eastern half of United States to the Great Plains.	Leaves shiny, long pointed. Flowers in long clusters (racemes). Cherry black, pleasant flavor. Timber tree.
Redbud (Cercis canadensis)	Eastern United States (south and west of New York).	Leaves heart-shaped, thin. Flowers bright purplish red, in clusters. Pods pink, 2 to 3 inches long.
Black locust (yellow locust) (Robinia pseudo-acacia)	Appalachian Mountain region. Widely cultivated and naturalized over United States.	Leaves compound of 7 to 17 rounded leaflets. Flowers white, sweet scented. Pods 3 inches long with tiny seeds. Wood very durable.
Holly (Ilex opaca)	Southeastern United States, north along coast to Massachusetts.	Leaves evergreen, stiff, spiny. Flowers of 2 kinds on separate trees. Fruit (on female tree) red berry. Christmas evergreen.
Red maple (soft maple) (Acer rubrum)	Eastern United States.	Leaves opposite, small, 3- or 5-lobed on red stems. Flowers red, opening before the leaves. Keys fall early.
Carolina Basswood (Tilia caroliniana)	North Carolina, Georgia, and west to Texas.	Leaves square at base, sparsely hairy below, smooth above. Branchlets smooth.

Name of Tree	*Where the Tree Grows*	*Descriptive Notes*
Swamp black gum (Nyssa biflora)	Coastal acid swamps, Maryland to Texas.	Leaves narrower than those of black gum (1 inch wide). Fruit small, stone prominently marked (ribbed).
Tupelo gum (Nyssa aquatica)	Coastal fresh water or "deep" swamps, Virginia to Texas, up Mississippi River. Not found in stagnant swamps.	Fruit large (1 inch), purple (plum), single on long stem. Leaves broadly elliptical, 5 to 7 inches long.
Dogwood (flowering dogwood) (Cornus florida)	Eastern half of United States.	Leaves opposite, oval, pointed. Flowers small, in dense head with snowy white bracts. Fruit red.
Persimmon (Diospyros virginiana)	Eastern United States, except northern portion.	Leaves oval (widest below middle), firm. Fruit fleshy, edible, stone seed. Close relative of Ebony tree of the Tropics.
White ash (Fraxinus americana)	Eastern half of United States.	Leaves opposite, of 5 to 9 leaflets each, broadly oval, usually smooth and whitish below. Flowers of 2 kinds on separate trees. Important timber tree.
Common catalpa (Catalpa bignonioides)	Central portion of Southern States.	Leaves opposite, broadly heart-shape, 4 to 6 inches long. Flowers in crowded clusters. Pods slender, thin-walled.

SUGGESTIONS FOR STUDY

Questions and Problems

1. How were trees first named by primitive people?
2. What is meant by the *common name* of trees and plants?
3. Why is the common name sometimes confusing?
4. What is meant by the *botanical name?*
5. Who first gave trees scientific names? When?

6. Why were the names given in Latin?
7. What is meant by the term *Tree Families?* Give an example.
8. How are the families divided? Give an example.
9. What is meant by the term *species?* Give an example.
10. What is meant by the term *genera?*
11. Why is it important to know how trees are named scientifically?
12. What is meant by habitat? Is this a Latin word?
13. Why should we know the habitat of trees?
14. Name some trees that grow in wet, swampy lands. Some that grow in the mountains.
15. Where does Longleaf Pine grow? Shortleaf? Slash?
16. How can trees be known, other than by name?
17. Describe the difference in the bark of two species of trees with which you are familiar.
18. What are some of the distinguishing characteristics of leaves? Of twigs? Of buds?
19. How does the wood in trees differ?
20. How is the kind of wood related to the use to which the tree is adapted? Give examples.

Selected References

U. S. Department of Agriculture, Washington, D. C.

M. C. 217—Forest Trees and Forest Regions of the United States.

State Publications

Every state has a publication dealing with the common forest trees of that state which may be secured from the State Forest Service. For example, Bulletin No. 6, *Forest Trees of Kentucky*, Kentucky State Forest Service, Frankfort, Kentucky. All of these are excellent references, invaluable to the individual who accepts the challenge, "Let's Know Some Trees."

Suggested Activities

1. Write to your State Forester and ask for the bulletin describing the common forest trees growing in your State.
2. Write to the U. S. Department of Agriculture and get all the available publications dealing with the important forest trees of your section.
3. Make a trip into the woods to observe the difference in growth characteristics of trees of different kinds.
4. Hold a contest among the members of the class to determine who can give the names (common names) of the greatest number of trees.
5. Collect leaves, seeds, and stems of a number of the more important trees in the community, bring them to class. Mount each with the correct name, and write a short description of each.
6. Learn to know at least ten trees growing in your community, or more in case you already recognize more than this number. Learn to know several with which you are not familiar and write a brief description of each.

CHAPTER 14

SOUTHERN FOREST TREES

EVERY person is interested in trees. Every country is known, in a measure, by the trees it grows. And since they live so long and look down upon the notable events of history, in the lore of every nation tree stories are found.

There are many famous trees in the South.

Did you ever hear, for example, of the Wesley Oak?

Under this tree, St. Simon's Island, off the coast of Georgia, John and Charles Wesley, pioneers of Methodism, preached. Thousands of members of the Methodist Church have made pilgrimages to this site of the establishment of their church.

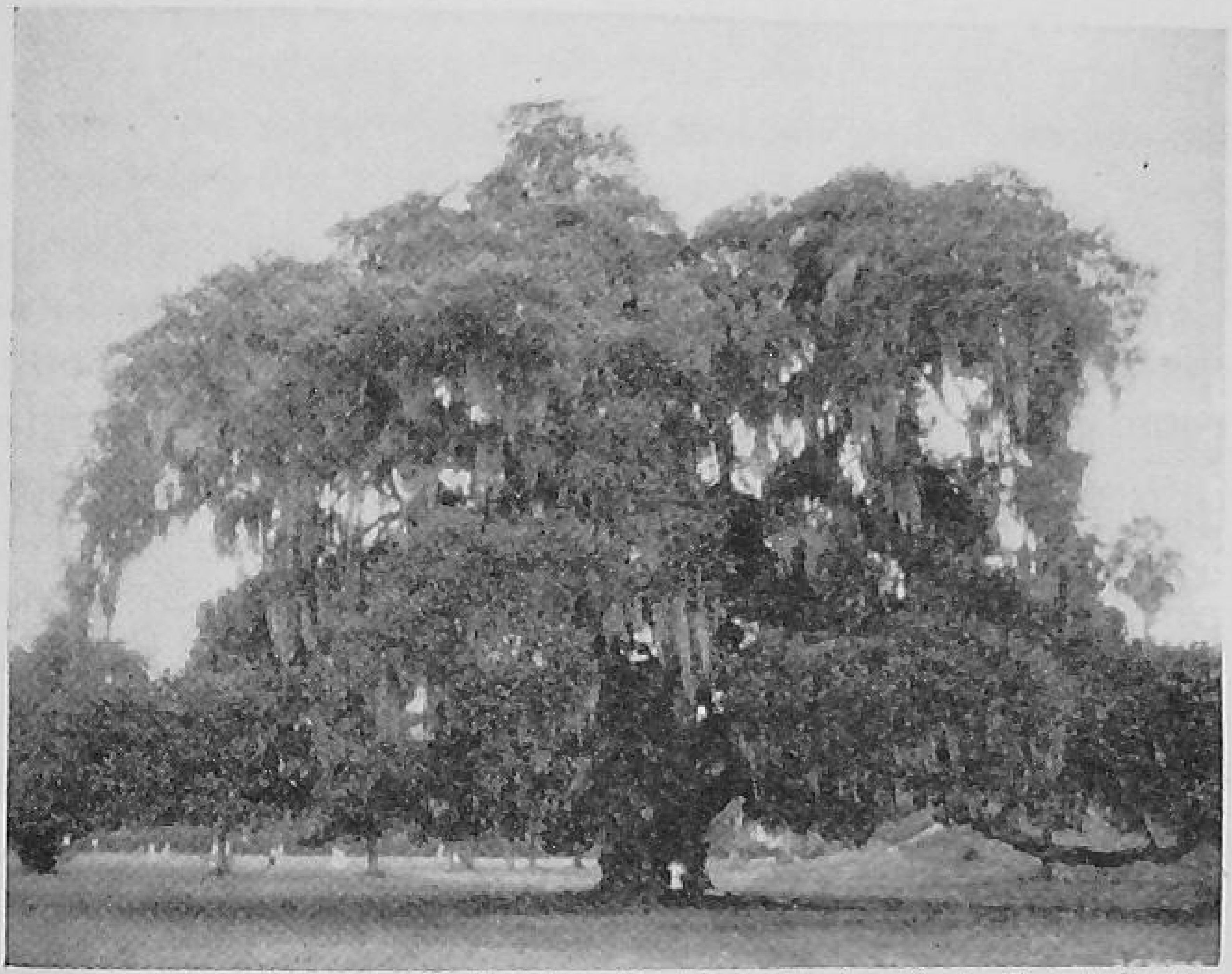
Also on St. Catherine's Island, which is near the site of the Wesley Oak, stand many beautiful live oaks like those from which *Old Ironsides* was constructed. In this same section may be seen the Lanier Oak, under which Sidney Lanier is said to have been inspired to write his great poem, *The Marshes of Glynn.*

In Florida, on the grounds of the Tampa Bay Hotel, may be seen the *De Soto Oak.* Here De Soto, who became the governor of Florida in 1539, signed a treaty with the Indians. And 350 years later, during the Spanish-American War, General Nelson A. Miles, established his headquarters under the same tree.

The Evangeline Oak, which has been immortalized by Longfellow in his poem *Evangeline*, stands today as a great giant at St. Martinville, on the Bayou Teche, in

Louisiana. It marks the spot where the Acadians, driven from Nova Scotia, landed in 1758, two years after their expulsion from their former homes.

In Tennessee there is a tree upon which Daniel Boone



Courtesy Southern Region U. S. Forest Service

A Majestic Live Oak in Louisiana

These trees, which remain green throughout the year and are often festooned with moss, are among the most beautiful trees of the South

carved his name as he blazed a trail into undeveloped country.

The Lonesome Pine, famous in song and story, stands in Wise County, Virginia.

A very interesting story is told of *The Washington Live Oak* at Charleston. In 1791, George Washington visited South Carolina. While in Charleston he was an honored guest in the beautiful plantation home of the distinguished Pinckney family. He heard the mistress of the household give an order to her gardener that the

large oak which obstructed the view from the new portico must be cut down. Washington, great tree lover that he was, expressed the wish that the tree be spared. It was.

In every state in the nation, and in every community, there are famous trees that are associated with important events. Every effort is made to save them from injury and death. Persons think of them as individuals.

Trees of Great Economic Value.—Just as there are individual trees that become associated with places, so there are species of trees that identify every section of the nation where trees grow. These are the trees of economic value; they are, for the most part, the forest trees.

Southern Forest Trees

Magnolia (Magnolia Grandiflora).—Perhaps one of the most typically southern forest trees is the magnolia, which grows prolifically throughout the lower Piedmont and Coastal Plain area of the southern states. It is a typical lowland tree and huge specimens may sometimes be found deep in the swamps and low places of the South.

The beauty of the magnolia cannot be fully appreciated until one sees it silhouetted darkly against the gold of a full southern moon, draped with wisps of soft spanish moss, or breathes the soft fragrance of its perfumed flowers. It is a tree which all the world knows, through songs and stories of the Old South; it is associated with lazy rivers and hidden bayous and gentle winds.

Scientifically, this tree belongs to the magnolia family, which was named after Pierre Magnol, professor of botany who lived over three hundred years ago. In

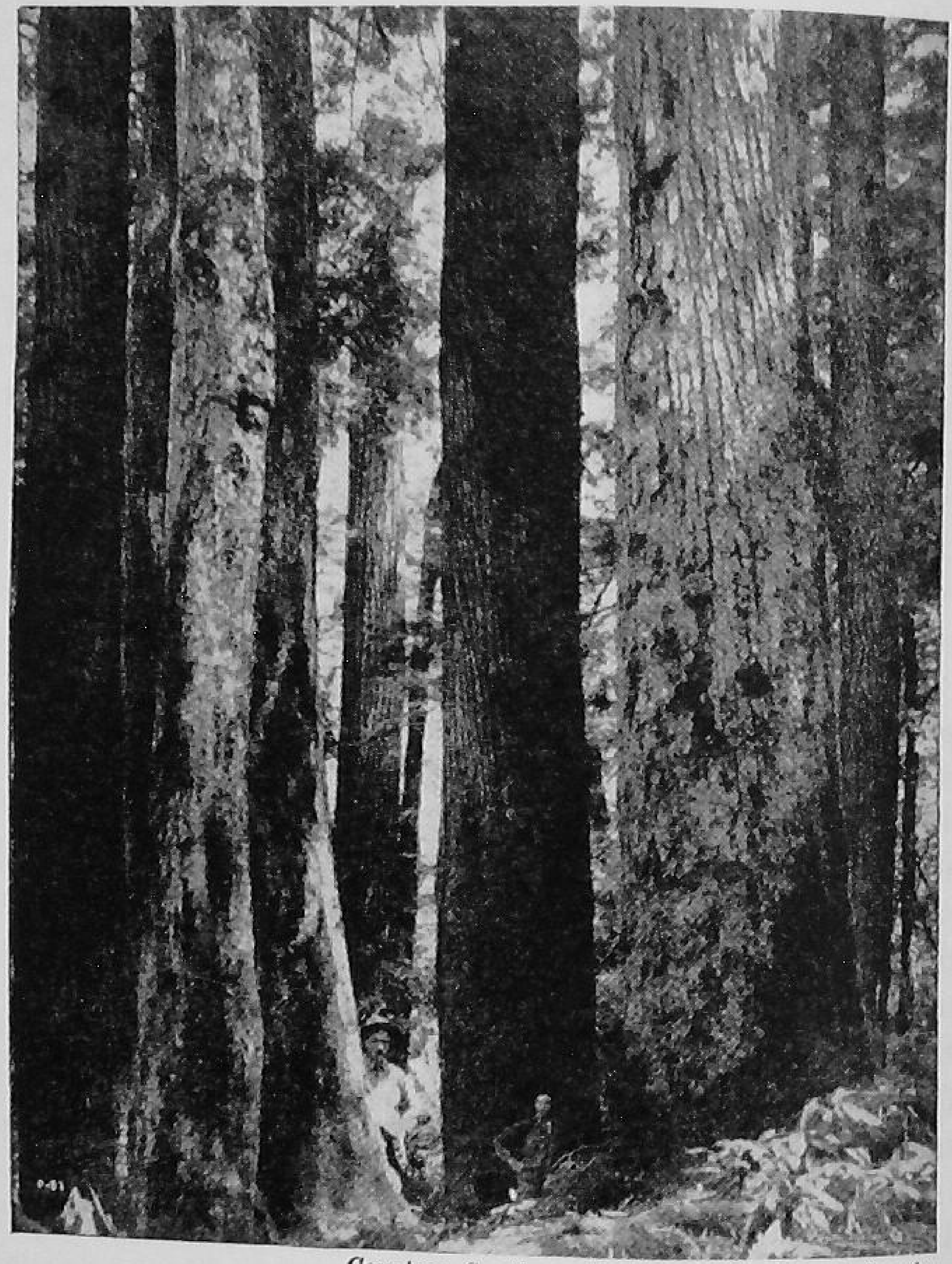
its family are species native to eastern Asia, as well as to the Americas. Its family habitat ranges widely from sea level to high in the Himalayas of Asia and the Appalachians in North America.

The large-flower, or laurel magnolia as it is sometimes called, has leathery, dark green leaves which cover the tree throughout the entire year, and which are coated on the lower surface with a rusty brown fuzz, except on the bright-green, tender young leaves. Its trunk is dark brown with thick, tough bark. The flowers have aptly been described as "large, powerfully lemon-scented creamy-white flowers," which grow in profusion on the tree in late spring. This description hardly does justice to the splendor of a large magnolia tree in full blossom.

Because the magnolia is generally regarded as altogether an ornamental species, few persons realize that it has a commercial value. Many times it is cut and sawed into lumber. The wood is hard and heavy, and is often used for furniture, interior finishing, and basket and veneer manufacture. Much magnolia lumber is sawed out of the southern forests each year.

Longleaf Pine (Pinus Palustris).—The longleaf pine is another typically Southern tree. Its range, however, does not seem to follow any special line of topography. In some portions of the South it grows no further north than the lower edge of the Piedmont Plateau. In other parts of the South, it is found high on the mountain sides. It grows near the top of Cheaha Mountain, Alabama's highest point.

The longleaf pine is perhaps the best known of all southern trees. Its long, golden-brown trunk (which sometimes seems out of all proportion to the rest of the tree), its heavy resinous needles, which grow in a rounded head on the ends of the twigs, its crown, high



Courtesy Southern Region U. S. Forest Service

FOREST GIANTS
On Santeetlah Creek, North Carolina

above the earth—all have a tendency to add a touch of splendor to this well-known forest giant.

The longleaf seedling is our only southern pine

seedling which has the appearance of a bunch of grass when it sprouts. For the first few seasons, this young plant devotes its entire attention to pushing its tap root deep into the earth and securing a firm hold before its crown starts shooting skyward at an enormous rate of speed. For this reason, the longleaf seedling is very resistant to fire, and in many places in the South, where fire has driven the other species into the swamps, the longleaf continues to hold its own on fire swept lands.

This species of tree does things in a big way. Its cones and seeds are several times larger than those of the other southern pines, and its needles are heavier and longer. The tree itself often grows over a hundred and twenty feet in height.

Commercially, the longleaf pine is very valuable. It produces a variety of products. A large amount of the world's naval stores comes from it. Because of its ability to grow tall and straight it is valuable for poles. Because of its quickly expanding heart and resinous wood, it is known as "Southern yellow pine" and produces the most valuable pine lumber known to commerce. For the same reason, it is valued as crosstie, fence post, and even shingle material. Because of its tough-grained strong wood, it is valuable as building material where strength is required. The brown, dried needles are used in making fancy baskets and mats. During the past few years, some of the large naval stores operators have found a profitable business in pulling longleaf stumps, left from extensive logging operations, out of the ground and extracting the raw resin from them.

The cold months of winter find a great deal of the "fat wood" or "lighter," which is the resin soaked wood, being used for fuel. It is inexpensive, for it can be

chopped from old stumps in the woods. It burns intensively for a long time. Many families of the South are kept warm throughout the entire winter with a pile of "lighter wood."

Cypress—Taxodium Distichum.—The bald cypress is familiar to everyone who knows the deep South. It appears on the Atlantic and Gulf coasts as far north as southern Delaware and as far west as Devil's River in Texas. It is typically a tree of the swamps, and as someone has expressed, "It's feet are always in the water."

Geologically, the cypress is one of our oldest trees. It dates back into the dawn of history, when hot, humid forests covered the face of the earth. One who has ever stood in a deep cypress swamp, in water and slime and mud, where little or no sunlight penetrated through the thick foliage overhead, can believe that. There is something that speaks of ages past, when monster dinosaurs existed and great saurians splashed through the swamps.

The cypress has distinct characteristics which would never leave a student in doubt as to its identity. It is one of the two conifers which sheds its leaves in the fall of the year and remains bare throughout the winter months. Its crown has a flat-topped appearance and its leaves are light, flat and feathery, which give the tree a softened appearance. Its cones, which contain the seeds, are about the size of a walnut. The base of the trunk is huge and expanded, many times larger than the normal diameter of the tree, and from the roots beneath the water, a soft, conical mass of wood, known as the "cypress knee," grows. Those knees, which are spongy in texture and usually hollow inside, act as lungs for the roots which are under water and cannot get air.

Many of the virgin stands of cypress have been cut out of the South, but a few are left. This tree is exceedingly slow of growth, and a large tree is usually very, very old. Sometimes it does attain a height of 170 feet and a diameter measurement of approximately 15 feet. Since most of our original stands have been logged, a cypress tree of this size is rare indeed.

Cypress wood is much in demand. It is soft, light, and straight-grained. For this reason it is easily worked. Because of its durability it is in great demand for shingles, fence posts, and poles. It will not rot in contact with the earth. *Pecky cypress,* which has an appearance of great age, is much valued as panneling in homes. Because the wood has great strength, it is used in heavy construction. It also has a number of miscellaneous uses as material for boats, water tanks, buckets and even water pipes. Economically, the cypress is one of the most important woods of the South.

Live Oak—Quercus Virginiana.—The oak family is one of the most important tree families to commerce. Its species are found widely distributed over the temperate zones of the earth. The deep, dark forests of Europe in the middle ages, the haunts of Robin Hood, the English Baron's hunting preserve, contained large numbers of oaks.

From some species of oak comes tannic acid; from some comes the cork of commerce. Out of 300 known species of this family, 55 of them are native to North America.

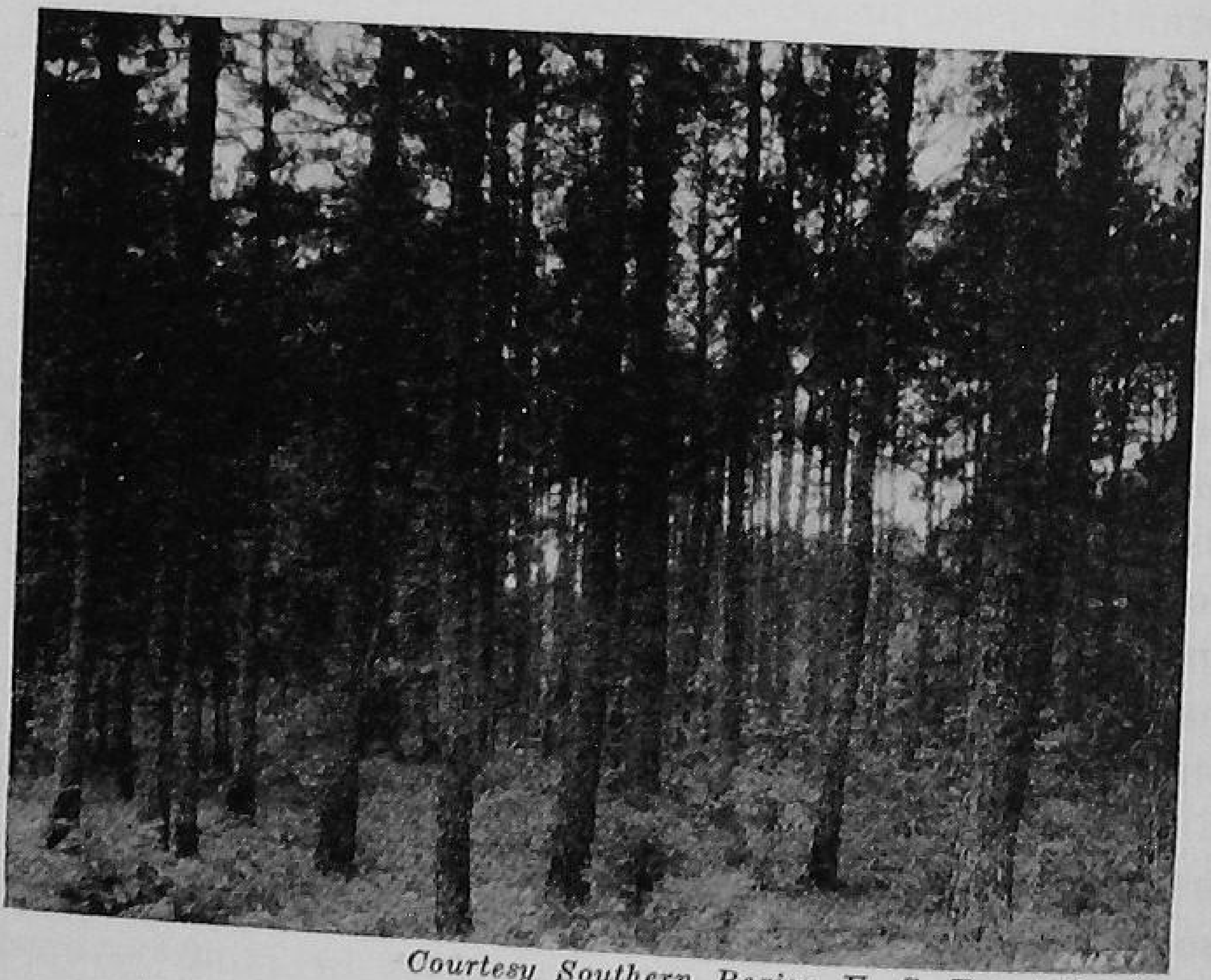
The live oak could hardly be classed as one of the most important trees of this family, but it is typically southern. It is the only Eastern representative of the evergreen oaks. Like many trees of the South, it has been widely sung by poets and writers of all generations, and is known around the civilized world.

The live oak is one tree which had much to do with the colonization of Georgia. When Oglethorpe landed on the Georgia coast, he and his settlers were impressed by the size of the pines and live oaks.

"Where such massive trees grow," they said, "is fertile soil, which will grow anything."

They drove a flag into the ground and claimed the land for England.

The live oak, because of its branching habit, has the



Courtesy Southern Region U. S. Forest Service

A Good Stand of Loblolly and Shortleaf Pine

appearance of being one of the largest trees in the South. The trunk is usually short and slightly twisted. A few feet above the ground the trunk branches, and sometimes the branches appear almost as large as the main trunk. Sometimes instead of growing upward, the branches of an ancient live oak will grow almost hori-

zontal with the ground, and the crown spread will be wider than the tree is high.

Experts say that two forms of live oak exist, the thick-leaf form and the thin-leaf form. The leaf of the thick-leaf live oak is said to curl conspicuously on the edges, while the curl of the thin-leaf form is very slight. The leaves are thick and leathery, light green above and pale silvery beneath.

The wood is very hard, strong, and tough and was formerly used in shipbuilding. Little of the wood is now used, and the tree is most highly prized for ornamental purposes.

Loblolly Pine—Pinus Taeda.—Perhaps one of the most misunderstood of all the southern trees is the loblolly pine. It grows throughout the Coastal Plain and Piedmont Plateau and is known by many names. In the northern portion of its range, under the shadows of the mountains, it is classed as a valuable timber tree, and its lumber rates with that of the longleaf pine. In the southern portion of its range, the loblolly is known as the black pine and is frowned upon as an outlaw species because it will not produce naval stores products in such quantities as slash and longleaf pines.

In spite of that, the loblolly pine is one of the valuable trees of the South. It has the claim of being a life saver for many families during times of need. Many a farmer who owned a small tract of land covered with loblolly pine, was able to cut and sell it for enough money to buy bread and meat for his family when cotton was practically worthless. During and after both World Wars, the loblolly pine proved a friend in need to both landowner and farmer.

The loblolly pine is not hard to recognize. Its sheath contains three needles which grow along the stem and are from 8 to 12 inches long. Its bark is dark brown

Courtesy Southern Region U. S. Forest Service

A Giant Tree in Nantahala National Forest

and heavily ridged. The tree is one of the fastest growing trees in the forest. It appears in old fields when they have been abandoned, and for that reason is sometimes known as old field pine.

The virgin stands of loblolly pine are almost gone. A few trees remain in inaccessible places. Most of the

stands of loblolly left in the South today are second growth. This second growth lumber is widely used for construction material where strength is not required. It is used a great deal for pulpwood, telephone poles, staves, crossties, and veneer. The second growth timber which is to come in contact with the ground is creosoted, to preserve it against rot.

Yellow Poplar—Liriodendron Tulipifera.— While the yellow poplar is not typically a southern tree, as are some of the others we have named in this chapter, nevertheless it is an important timber tree in the South, and should be included among the foremost of the list of commercial trees of the South.

The yellow poplar, found throughout the Southern states belongs to the magnolia family. This fact is easily recognized by its magnolia-type flowers, its seed pods which are made up in much the same manner as those of the true magnolias, and even its twigs, which are smooth, flat, and waxy in appearance.

While yellow poplar is found throughout the South, it seems to prefer the low swampy places of the Coastal Plain and Piedmont and the deep, moist coves of the mountains. It will not survive on high, arid slopes.

In the extreme southern portion of its range, this tree species seems to grow as a part of the mixed hardwood forests, thriving with ash, hickory, oak, and gum to make a typical swamp woodland. In the mountainous sections, it is many times found in pure stands, dominating the other tree species in the coves.

Many stories are told about the yellow poplar, or tulip tree. One of the most interesting stories comes out of the coves of Santeetlah Creek, where this tree grows to enormous diameter and amazing height. It is said that many years ago, a pioneer, moving into that section, found an enlarged base of a huge poplar, some

twelve or fifteen feet in diameter. He beveled off the trunk, built a roof on it, and moved in, where he reared a family.

The wood of the yellow poplar is important commerically. Its name is derived from the light yellow or brown color of the wood. It is soft and easily worked, which makes it valuable for such purposes as veneer wood, furniture, interior finishing, boxes, and shingles. In fact, its use is almost unlimited where high-grade wood products are required.

Slash Pine—Pinus Caribaea.—While the slash pine has been, for many years, an important tree to the South, recent discoveries in the use of these trees for the pulp and paper industry now place them in the important position of becoming one of the most desirable tree species in the nation.

The slash pine is one of the most southern of southern trees. It grows in the lower South, deep in the Coastal Plain country, and even its specific scientific name *Caribaea*, indicates that it is most generally found around the Caribbean Sea.

Since the naval stores industry came into prominence, this tree has been recognized as one of the vital units to that industry. It produces more resin than any of the other pines, and therefore has been artificially planted to a much greater extent than the longleaf. So vigorously do these trees grow that a few years ago turpentine operators began to work faces on even the smallest ones—those hardly large enough to hold up a resin cup. Recent experiments, however, have shown this practice to be unprofitable, and today only trees over a certain diameter limit are being worked for turpentine.

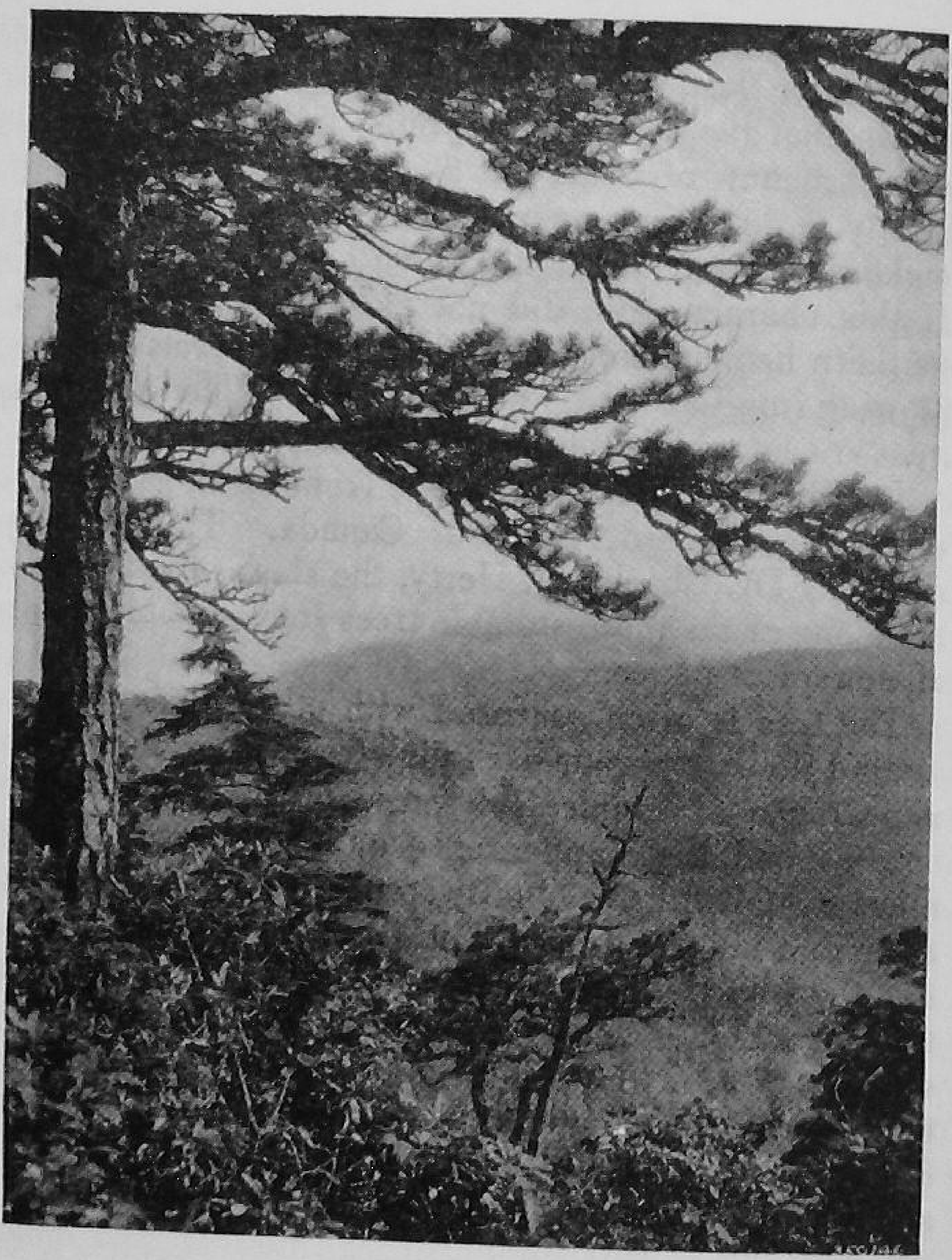
Because of its ability to produce a great deal of resin, the tree cells were always thought to be full of the heavy liquid, and that chipping through the bark merely

opened the tiny cell spigots and drained the tree. Within the last few years, however, experiments have shown that the cells of the young trees do not contain great amounts of resin, but that the tree merely has the ability to throw into operation certain tree machinery to make and pour this liquid salve out upon its wounds. If this characteristic did not exist, trees living in the southern hemisphere, where destructive insects and fast growing fungi abound, would soon die. When the young trees are cut, unless they have been turpentined, the wood cells are found to be almost free from resin, as much so in fact as the red spruce of Canada. Through tests made by Dr. Charles H. Herty, the slash pine is known to be one of the more suitable trees for the manufacture of newsprint paper.

The tree is often confused with other pines growing around it. A vigorous dark pine tree will often have the appearance of longleaf, because of the length of its needles and their appearance on the branch. Sometimes it looks like a loblolly, because its needles do not grow in a clustered head, but along the branches, much like those of the loblolly pine. A sure method of identification, however, is the number of needles in the sheath. Where the longleaf and loblolly pines grow three needles in a bundle, the slash grows both two and three, and many bundles containing either two or three needles will be found on one branch.

The wood of this tree is strong, durable, and tough, and the heart of the tree is very resinous. Many times the lumber from slash is confused with the lumber of longleaf pine and sold under the name "Southern yellow pine." Construction timbers are often cut from this tree and its wood is used wherever heavy, durable wood is needed.

Black Walnut—Juglans Nigra.—The most valu-



Awe-Inspiring Grandeur

A scene in the Southern highlands, Pisgah National Forest, looking toward Shordoff from the trail of Table Rock

able single tree species grown commercially in the southern United States is the black walnut. Because of the value of these trees, during the past few years many of the old specimens have almost disappeared and only

a few of the valuable trees containing a great deal of heartwood remain.

The black walnut grows throughout the states east of the Rocky Mountains. It is a large tree, usually less than a hundred feet in height with a large crown. Its leaves are compound, smooth and green above and hairy beneath. The tree itself occurs singly and rarely, if ever, is found in forest stands. Many times it is planted along fence rows and along the entrances to driveways.

An important item of commerce is the walnut. This nut is richly flavored and is desirable in the manufacture of candy, cakes, and many other delicious confections and desserts. At one time the nuts from this tree sold for $100.00 per ton, and the shelled kernels brought as high as $1.26 per pound.

Hickorys and pecans also belong to the same family as the walnut.

Howard Spence says of the walnut—"The beautifully mottled and figured wood obtained from near the roots and from the crotches has a high value for veneer. Owing to its non-warping quality, walnut is used largely for gun stocks, for which it has no equal. The seasoned wood weighs about 45 pounds to the cubic foot, is moderately hard, compact, even grained, easy to work and split; it shrinks very little in seasoning and does not crack or warp. It should be allowed a long time in which to season thoroughly."

Much land is now being planted to walnut trees. Many landowners have begun to realize that in a few years this valuable tree will be very much in demand, and it is now being planted more extensively than ever in the southern states.

Shortleaf Pine—Pinus Echinata.—The pine tree of the South which is characteristic of the Piedmont

Plateau and more mountainous sections of the South is the shortleaf pine. Although this tree overlaps into the scrub pine sections and extends far down into the range of the loblolly pine, it is seldom found growing out upon the Coastal Plain mixed among the longleaf and slash pines. Sudworth's "Check List of Forest Trees" gives

Courtesy Texas State Park System

A TEXAS STATE PARK

This view along the eight-mile drive connecting the Bastrop and Buescher areas is typical of the Buescher Park while Bastrop's principal trees are pine. Moss covered oaks and dense undergrowth characterize the Buescher area

its range as far south as the Chattahoochee Region of Florida but it does not predominate as a species that far south.

The shortleaf pine is characterized by having only two slender, dark green needles in a bundle and by hav-

ing the smallest cones of any of the pines. The needles are usually from 2 to 5 inches in length, and the cones are seldom over 2 inches long. These cones are persistent in remaining on the trees, sometimes for several years.

The shortleaf is one of the slower growing of the southern pines. Old trees have a very small ring of sapwood, the heart extending almost to the bark. For that reason, shortleaf lumber has been sold as "Southern yellow pine," along with the other species. Old lumbermen say that when certain of the old shortleaf pines are sawed they have a distinct, sweet odor that is pleasing to the senses. For this reason, they have been designated as "Rosemary Pines," and are thought in some localities to be a distinct species.

In many places of the upper Piedmont Plateau, shortleaf and loblolly pines struggle for supremacy in abandoned fields. They often come in together and form a mixed stand of the two species. The shortleaf is one pine species that will sprout from the stump.

Shortleaf heartwood is usually orange or dark yellow. It is heavy and fine grained and excellent for interior finishing. The wood of this species is also used in heavy construction, in making crates, boxes, excelsior, cooperage products, and in general construction.

White Oak—Quercus Alba.—No list of commercially important trees in the South would be complete without the white oak. Throughout its natural range, it is said to be one of the most important timber trees in the United States.

White oaks in the South often attain a height of 80 or 100 feet with a diameter of four or five feet when grown in the forest. Individuals which grow alone usually have huge symmetrical crowns and many times attain a diameter of eight or more feet.

The white oak is easily recognized throughout the year by its light gray scaly bark and by its characteristic smooth, deep-lobed leaves which are light green on top and very pale underneath. It is a foremost member of the entire oak group and has acorns which mature in one season.

Transplanting the white oak seedling is difficult because of its long taproot. For this same reason it is one of the most aggressive competitors for the food and water of the forest and in the struggle for existence.

The acorns of the white oak are valuable as food for swine, and in many places they are roasted and used as coffee. This acorn has less tannic acid content than many of the other oak species, and for that reason the Indians often ground them into meal, washed out the acid and used the starchy meal for making their cakes.

The wood of white oak grows slowly but is very valuable. The conspicuous medullary rays make it a beautiful material for use in the construction of furniture and furniture veneer. Because it is strong and heavy it is used in ship building, in making implements and wagon bodies, and in making tight cooperage products. It also makes beautiful flooring material. The plant itself, because of its longevity and its shape, is many times planted for ornamental purposes.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are some of the famous trees mentioned in this chapter? What kinds of trees are they? Why does one species predominate?
2. Do you know other famous trees? Where are they located? What species are they?
3. Are there famous trees in your community?

4. What are some of the species of greatest economic importance in the South? In your locality? Why are these trees valuable?
5. What Southern forest trees are discussed in this chapter?
6. What is the species of greatest economic value in your locality?
7. Discuss each of the trees mentioned in this chapter giving the characteristics and uses of each.
8. What are some of the trees of economic importance not discussed in this chapter?
9. For what trees is the South most noted?
10. Which is the most valuable of the pines? How do the longleaf and the slash compare?

Selected References

U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletins
1256—Slash Pine
1392—Black Walnut
1486—Long-leaf Pine Primer
1517—Loblolly Pine Primer
1628—Growing Black Locust
1671—Shortleaf Pine

Forest Service
Famous Trees, by D. Priscilla Edgerton
Leaflets dealing with tree species

Suggested Activities

1. List the ten most important tree species grown in your state, giving the characteristics and uses of each.
2. Select one species for special study and write a paper on trees of this kind giving all the information possible.
3. Prepare a discussion of *Famous Trees in My State*, having each member of the class tell about one famous tree.

UNIT V—FOREST ENEMIES

Chapter 15

PROTECTING FORESTS FROM FIRE

FIRE is the greatest menace to profitable forestry. Each year losses from forest fires in the United States, prior to 1940, were in excess of $50,000,000. Of this vast sum, $42,500,000 represented the annual loss in sixteen southern states, while the damage in all other states in the nation was about $7,500,000. In other words, annual fire losses in the South have been four times as great as those in all other regions combined.

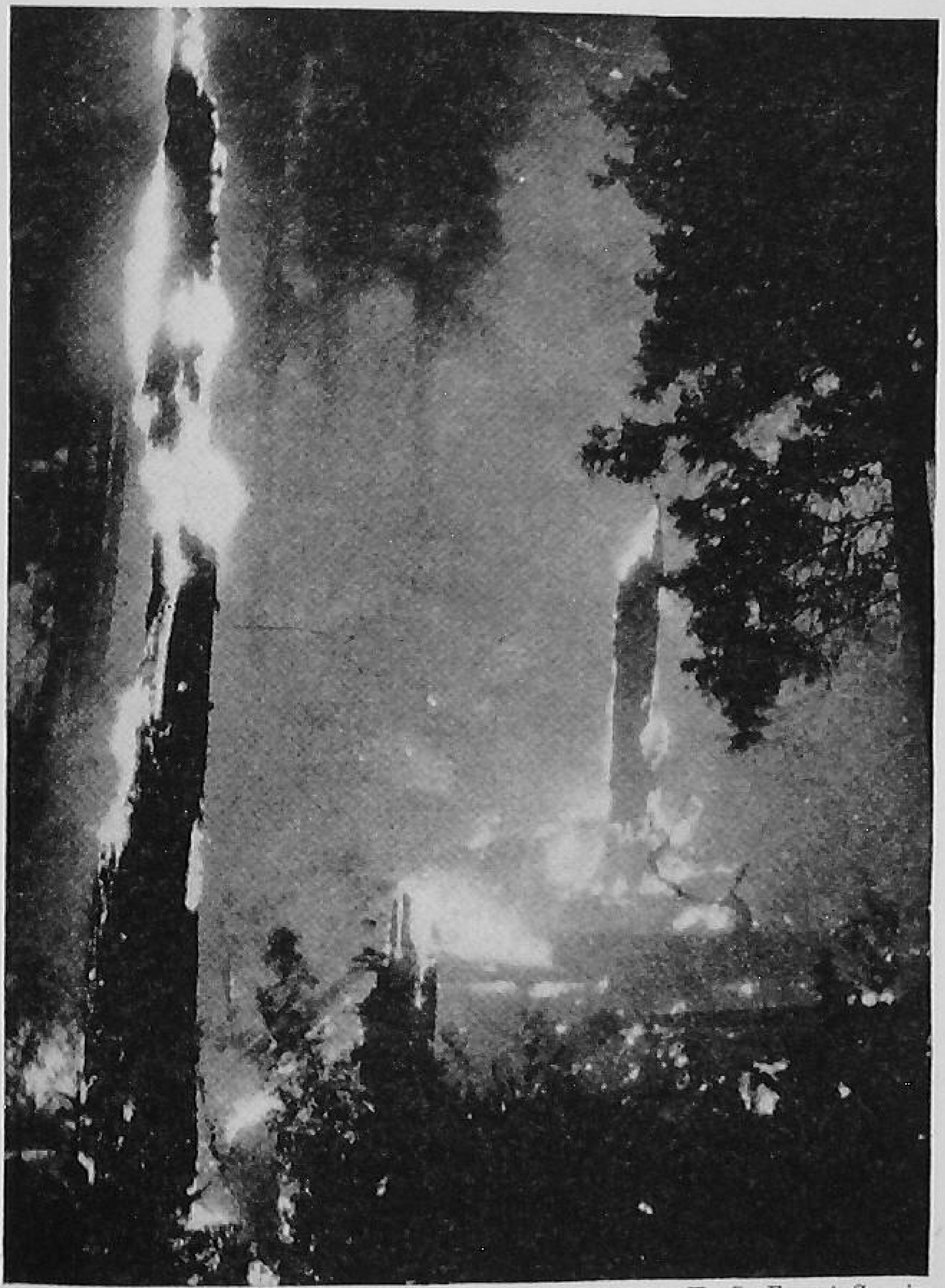
Why, you may wonder, are the losses in the South so much greater than those in other parts of the nation?

There are many reasons, but the most important is the attitude of our people.

In the South it has been customary for many years to "burn off the woods" once a year. This was done by cattlemen who thought burning improved grazing in the early spring. It was done by turpentine operators for convenience in getting through the woods and as protection from snakes. It was done by persons who "just liked to smell a pine tree burning."

An entirely different attitude exists in the West.

In the great forest areas of the far West, men *fear* fire in the forests. They fear fire because of the economic loss it causes in the destruction of valuable tim-



Courtesy U. S. Forest Service

FIRE—A MENACE TO PROFITABLE FORESTRY

Eighty per cent of the forest fires in the nation occur in the Southern states. We must change the attitude of our people toward fire in our woodlands if we expect to make our forests more profitable

ber. They fear it also because fire in that region is more difficult to control, and because it may destroy other property, including homes and cities.

MOST OF THE FOREST FIRES OCCUR IN THE SOUTH

"Did you ever see a forest fire *crowning?*" asked a visitor from the West.

"What do you mean?" inquired the Southerner to whom the question was addressed.

"I mean a forest fire raging through the tops of the trees—a fire that pours forth a seething mass of flame that moves rapidly and destroys everything in its pathway. Fortunately, you have few such fires in the South. Yours burn more slowly, but the ultimate damage is just as great."

This is true. In the South where the rainfall is much greater than in the West the fire hazard is not so prevalent and the fires are not so spectacular. In the West every precaution is taken to prevent fires. Even campers will not start a fire when a breeze is blowing. And if a fire cannot be controlled by the available force of workers, every citizen may be called upon to become a fire-fighter. All respond willingly.

In the South a new attitude toward fires is being created. We are beginning to realize that forest fires must be prevented. We are beginning also to appreciate the extent of the loss sustained when fires are not controlled. These losses for the southern states are shown in the table on page 299:

Forest Fires In The South

Compiled from the printed report, Forest Fire Statistics, published annually by the U. S. Forest Service

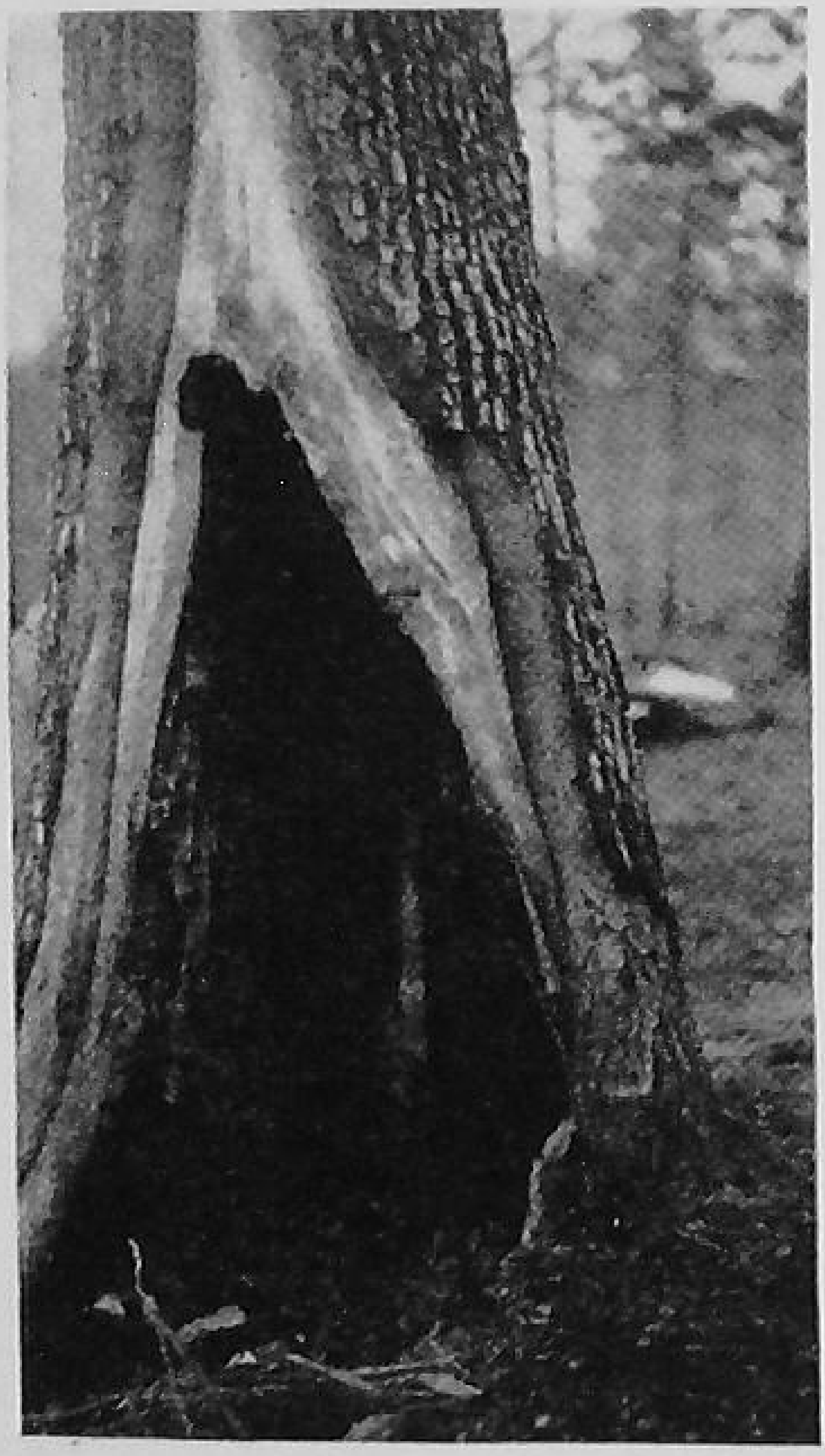
State	*Acres Burned Annually*	*Annual Damaged*
Alabama	1,019,671	$ 1,208,990
Arkansas	702,776	886,955
Florida	4,845,173	4,890,537
Georgia	2,273,036	2,846,721
Kentucky	316,268	553,830
Louisiana	1,202,553	344,428
Maryland	3,677	26,772
Mississippi	4,252,144	9,632,814
Missouri	673,175	1,706,947
North Carolina	188,531	306,816
Oklahoma	2,539,958	3,870,625
South Carolina	213,882	629,681
Tennessee	513,967	1,013,963
Texas	3,254,670	7,408,820
Virginia	25,100	143,511
West Virginia	62,044	303,415
TOTAL	22,086,625	$35,774,825

The annual loss from fires as shown above represents a sum greater than the income derived from some of the more important crops for which the South is noted. It is being reduced through fire protection measures that have been instituted, most of them in recent years. But there is much yet to be done. "The forests of Virginia represent one of her greatest natural resources. Forest fires are the greatest enemy of this natural resource." This is a statement taken from a publication of the Virginia Forest Service. It applies to every state in the South as forcefully as to Virginia.

How can we learn to protect our forest resources? By reading everything we can find about fire pre-

vention and control; by observing the damage caused by forest fires; and by talking with persons engaged in forest protection work.

A Trip with a Forest Ranger.—Not all students are so fortunate as John Coulter. He had the opportunity to walk through the Appalachian Mountains with a ranger who had spent his life in the forests. They observed a hardwood stand through which fire had burned year after year. Apparently little damage had been done, but to the trained eye of the forester few trees had escaped the blighting effects of fire.



FIRE DAMAGE

Fire destroyed this tree as it does millions upon millions of trees in the South each year. Thoughtless individuals do not realize that fire injures large trees, but once the bark is burned, the tree is left exposed to the attacks of insects and disease

They stopped to examine the base of a tree.

"Look!" the ranger said. "It is hollow."

And it was. There was an ugly scar, which the growing tissue of the tree was trying to hide.

"Do you know what caused that?" the ranger asked.

John was not certain.

"Fire," the ranger continued. "That injury was caused by a ground fire which moved along the forest floor. It did not seem to be causing any damage. But

it was. Each time that a fire burned against the base of a tree like that one, the bark became so hot that the cambium layer, or growing tissue immediately under the bark, was scorched. It could not endure the intense heat, so it died. The bark, which protects the growing cambium, being of no more value to the tree, dropped off.

"This loss of bark exposed the tree to all of its enemies. Insects, which had been flying in the air, waiting to prey upon it, attacked the tree in hordes, eating into the tender wood immediately under the cambium layer. Fungi, and other parasites, gained entrance to the unprotected wood. The wood, which in a healthy tree conveys the sap to the leaves, was partially destroyed. As a result, the growing functions were interrupted. Today the tree is worthless as lumber; in a few more years it will probably be blown down in a storm."

They walked up the ravine and came to a stand of beautiful pines, through which the same fires had burned year after year. John looked closely to find some evidence of fire damage. He was unable to find any hollows at the bases of these magnificent trees.

"These trees are not hollow," he observed.

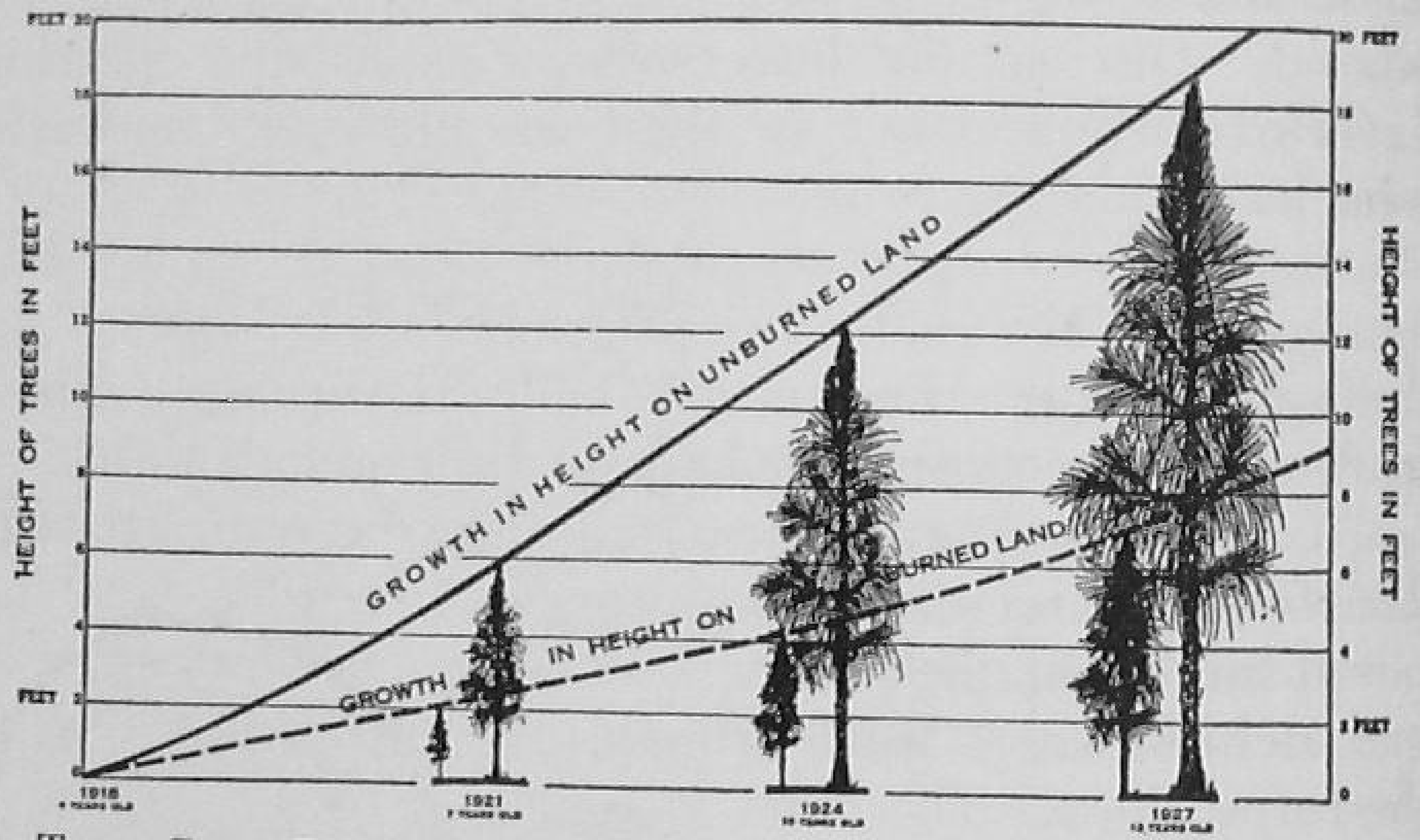
The ranger smiled.

"The pine is protected from that sort of damage," he replied, "but there are other evidences of loss from fire.

"First, you will notice that there are no seedlings or young trees on the forest floor. That is because they are burned and killed each year and there is never a crop coming on to take the places of these trees when they become old and die. For trees do become old and die just as do humans. That is, unless they are harvested. These trees are fruitful, and each year they produce millions and millions of seeds. The few fertile seeds,

which the birds or mice do not eat and which finally grow into tiny seedlings, are burned to a crisp, even though the fire never gets large enough to blaze more than a few inches above the ground.

"Now, if you will notice the bases of the larger pines,



Trees Grow Faster in Protected Forests Than in Burned Woods

A comparison of the growth on two similar tracts of pine land, one of which was burned while the other was protected, shows how fires check height growth.

During the ten-year period over which measurements were made the burned trees averaged about one-third the height of the protected trees. In other words, the protected trees made 270 per cent better growth than the burned trees. In addition to slowing down the growth of the living trees the fire killed, and destroyed, many little trees.

It may be noted from a study of the chart that trees in unburned woods were nineteen feet high, while trees in burned areas were but six or seven feet in height, after a ten-year growth period. This means that fires destroy the economic advantage which the South has in rapid tree growth.

you will see that the bark is very thick. That is Nature's manner of protecting trees against the heat where fires occur with regularity. The wood underneath becomes coarse and, as a rule, it is not suitable for timber. If you want to see what I mean, try splitting the base of

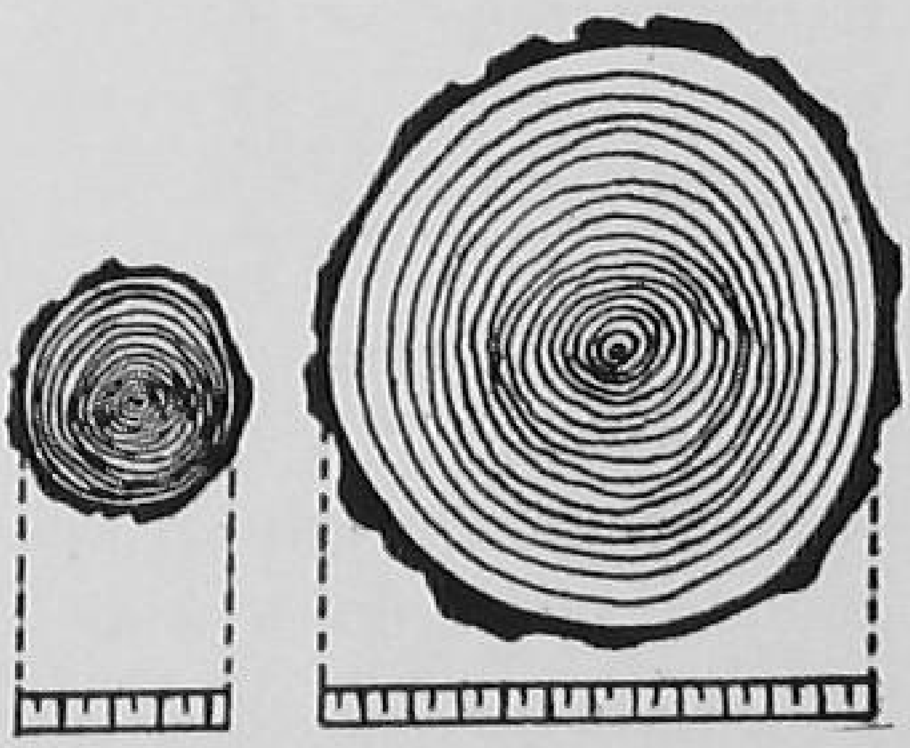
this tree into cordwood. You will have a job on your hands.

"Sometimes, when the cambium layer is killed and the bark does fall away from the tree, the wood cells underneath are able to repair the damage. In pines, these wood cells make resin and pour it out upon the wound. Disease and insect pests cannot penetrate this layer of salve and in time the bark and cambium heals over it.

Forest Fires Destroy Plant Food

"I dare say the trees in this stand are very old. They grow slowly because they have so little plant food.

"You realize that plants, like animals, must be fed. The food of trees is composed largely of the leaves and debris which fall to the forest floor. These decay and the food which they contain, in a soluble form, leaches into the soil where it is absorbed by the roots of the trees. When these leaves are burned most of the plant food is destroyed. It passes off into the air, and, so far as the forest is concerned, it is lost. We have noticed that where we burn the woods, the trees grow very slowly. They are starved, just like a boy who does not get enough to eat."



End views of two trees of the same age. Close rings of the one on the left denotes slow growth due to fires. Wide rings of the one on the right show rapid growth as a result of protection from fire

"Did you say you burned the woods?" asked John.

"Yes," replied the ranger. "This is an area in the National Forest which is used as a demonstration plot.

The workers at the Experiment Station burn the woods to study the results of burning. In this way we have accumulated valuable data about the losses from fire.

Fires Increase Erosion and Floods

"Over there, for instance, is a gully which has started between two trees. That is another example of what fire does in the woods. The leaves and litter which fall and rot together, form a thick layer on the forest floor. This layer acts as a sort of sponge to absorb the rains and melting snows, and let the water off gradually through the springs and streams. When this sponge has been burned away, water runs off quickly, carrying the soil with it. Thus erosion begins. More rain falls. It concentrates in this low place where soil has been washed away. The trickle becomes a torrent, and the force of the water makes a gully through the forest. In time this gully will become so large that it will wash the soil from underneath the large trees.

"Sometimes this water, unchecked in the forest where it first falls, runs down into the streams and with water concentrated from a wide area, floods the large rivers, which then wash away towns and cities, take human lives, and cause property damage of many millions of dollars."

As they walked up the trail, toward the top of the mountain, the old ranger continued to talk, telling John Coulter how fires were started in the woods. He explained that fires started in many different ways.

"Here is a report," he said, handing John a piece of paper taken from his notebook, "which shows how forest fires are started. This is a record of more than 60 million acres of forest land operated under fire protection. A careful check of all fires over a period of years has been made so that we feel reasonably certain

that we know how most fires are started in southern woodlands."

Below is given the report which was placed in John's hands.

HOW FOREST FIRES ARE STARTED

Cause of Fires	*Number of Fires*	*Per cent*
Incendiary	12,439	44.0
Smokers	4,099	14.5
Debris burning	3,436	12.0
Unknown	3,146	11.0
Micellaneous	2,285	8.0
Campers	1,393	5.0
Railroads	798	3.0
Lumbering	493	1.7
Lightning	219	.8
Totals	28,308	100.0

"From the report you will see that most fires are incendiary, which means that they are set purposely by the person starting the fire. If we could control such fires in the South, our problem would be much easier to solve.

"Then we have the classes of careless individuals, including smokers and campers, who do not intend to set fires, but who are careless with matches and cigarettes, and who do not thoroughly extinguish their camp fires.

"Debris burning means all sorts of brush burning such as is done by farmers. They should be very careful about such fires. Very often they are started when the wind is so strong that they cannot be controlled. A little fire soon becomes a big one. They should not be started in dry weather either. It is always better to start burning trash, if it must be burned, early in the day. This reduces the hazard of getting a fire started which is not put out before nightfall.

"One should never leave a fire untended for even a moment. But all these suggestions and others dealing with brush burning fires have been included in a publication of the Virginia Forest Service from which the following suggestions are given. You might like to study them," concluded the ranger, handing John a page from his notebook:

Suggestions for Brush Burning and Clearing Fields

A. *When We Should Not Burn*

1. Between March 1 and May 15.
   Between October 1 and December 15.
2. On a clear day any time in the year when the forest floor is dry.
3. In dry or windy weather.
4. Late in the morning or before 3 o'clock in the afternoon.

B. *How to Burn*

1. Arrange brush in small piles, burning one pile and feeding on it the brush from other piles nearby, which operation will result in the least number of piles of embers.
2. Make a wide path or fire line, free from grass, logs, leaves, or sticks, entirely around the area to be burned.
3. Burn against the wind. Burn down hill.
4. Employ sufficient help to care for any emergency that may arise. Have sufficient tools available.
5. Never leave the fire untended before the last spark is out—dead out.
6. Carefully inspect the burned area the next morning.

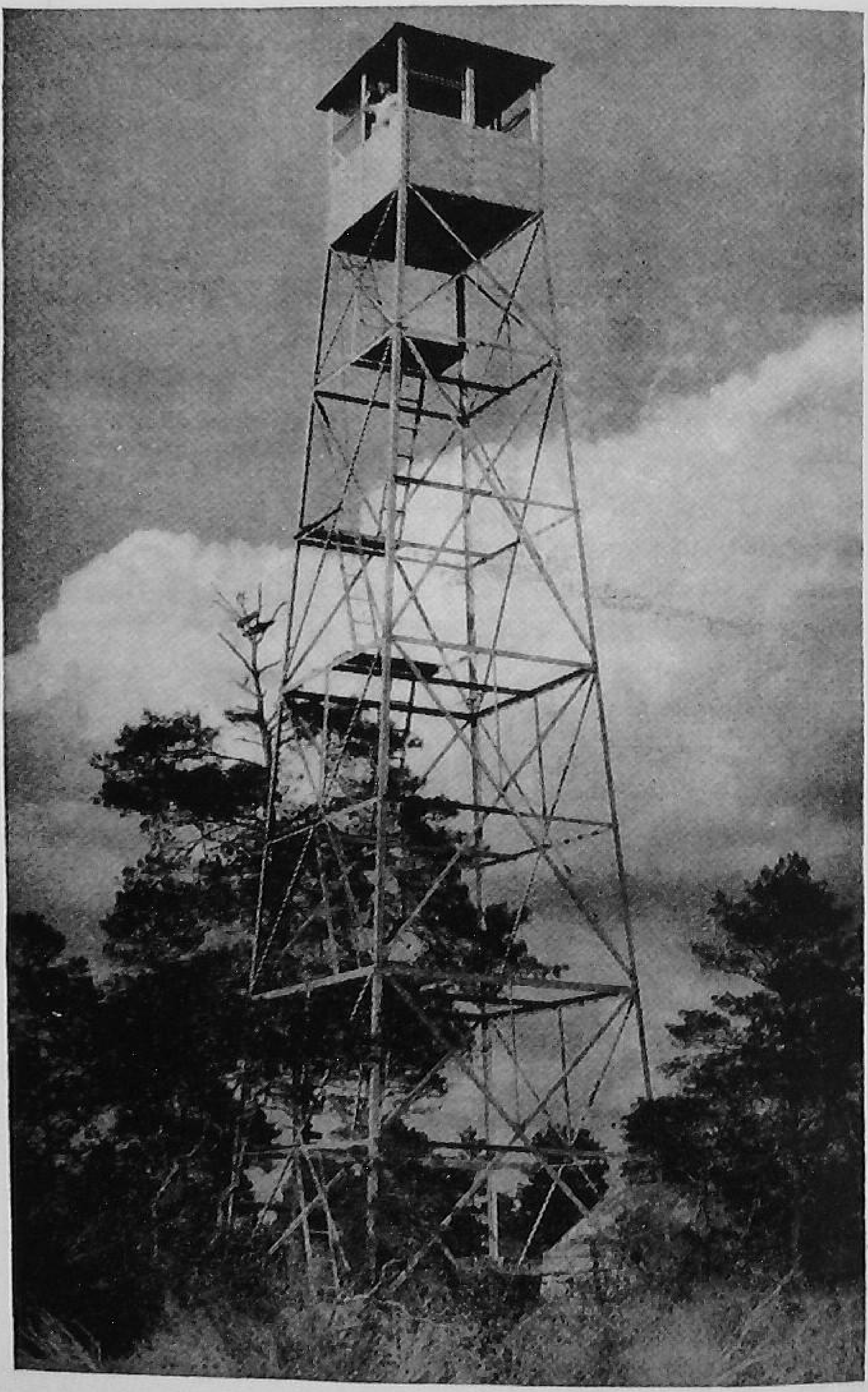
"Many states," the ranger continued, after John had looked over the suggestions, "have reduced their fire losses by passing fire laws and rigidly enforcing them. In one state it is a penitentiary offense for maliciously

What We Must Remember About Fire

1. Uncontrolled fire is a destructive and dangerous force.
2. The forest is valuable property. The leaves of trees, the branches, and other plant material found on the floor of the forest are very inflammable under certain conditions. The most dangerous forest fire seasons in Virginia usually are from March 1 to May 15 and from October 1 to December 15. During dry periods fires will also burn during the summer months.
3. Fires in the forest kill little trees and kill or injure big trees and retard their growth. Forest fires destroy game animals and young birds and their food. They increase the danger of "washing" of the soil, destroy the natural beauty of the countryside, reduce the fertility of the forest soil and create idle land that is a tax burden.
4. An individual has a right to have a fire on his own property and to burn any part or all of his property, but has no right to jeopardize or damage the property of his neighbor or work harm to the welfare of the community.

Virginia Forest Service

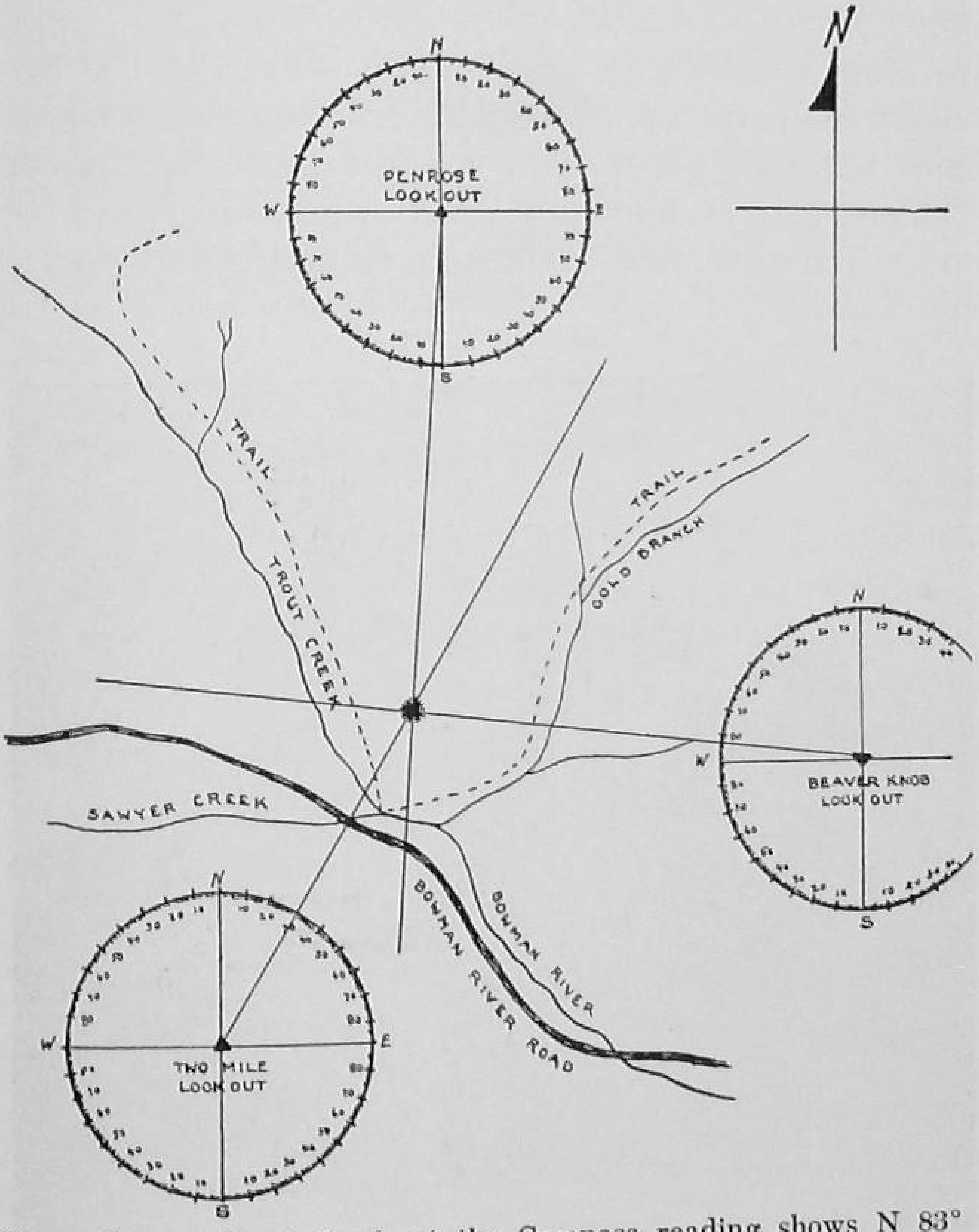
setting fire to woods or grass. In some states any person who sets a fire for any reason may be fined $500 in addition to paying for all damage done by the fire as well as the cost of putting it out, provided that the fire gets off his own property. There are strict regulations governing the operations of sawmills. These regulations provide that all engines or boilers have spark arresters and that the premises be kept clean of inflammable trash for a specified distance from all boilers and slab fires. Through the enforcement of such laws, the creation of



A Fire Tower

The fire towers now being erected in all parts of the South are symbols of the interest which the citizens of the nation are taking in the conservation of the natural resources from which most of our wealth comes

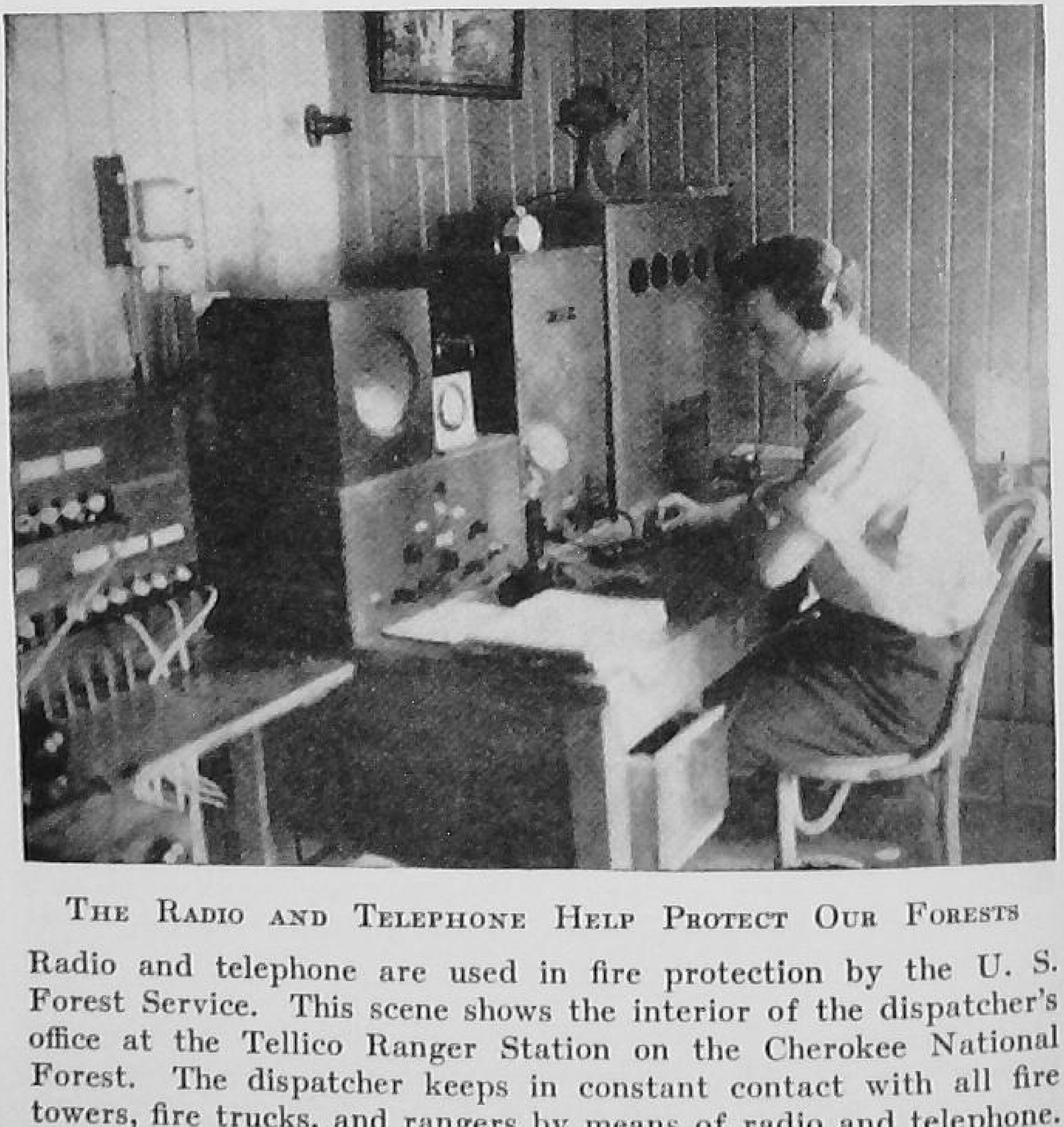
the proper attitude toward the protection of natural resources, and the forest protection measures now available, the loss from fires is being reduced rapidly."



From Beaver Knob Lookout the Compass reading shows N 83° W; From Two Mile Lookout the Compass reading shows N 29½° E; From Penrose Lookout the Compass reading shows S 5° W. Where the lines of those three readings crossed, the ranger knew he could find the fire. A crew was dispatched immediately up the Bowman River road and went in on foot from the junction of Sawyer and Trout Creeks

Locating and Fighting Forest Fires

The trail John Coulter and the ranger were following slanted abruptly upward and ended on a high mountain top. There, in front of them, was one of Uncle Sam's fire lookout towers, a net-work of heavy steel with a lookout house on top. They climbed the steps to a room which was half glass. Below and beyond were mountains and valleys, a magnificent view of unbroken forest land. The mountains on the horizon were clothed in blue haze.

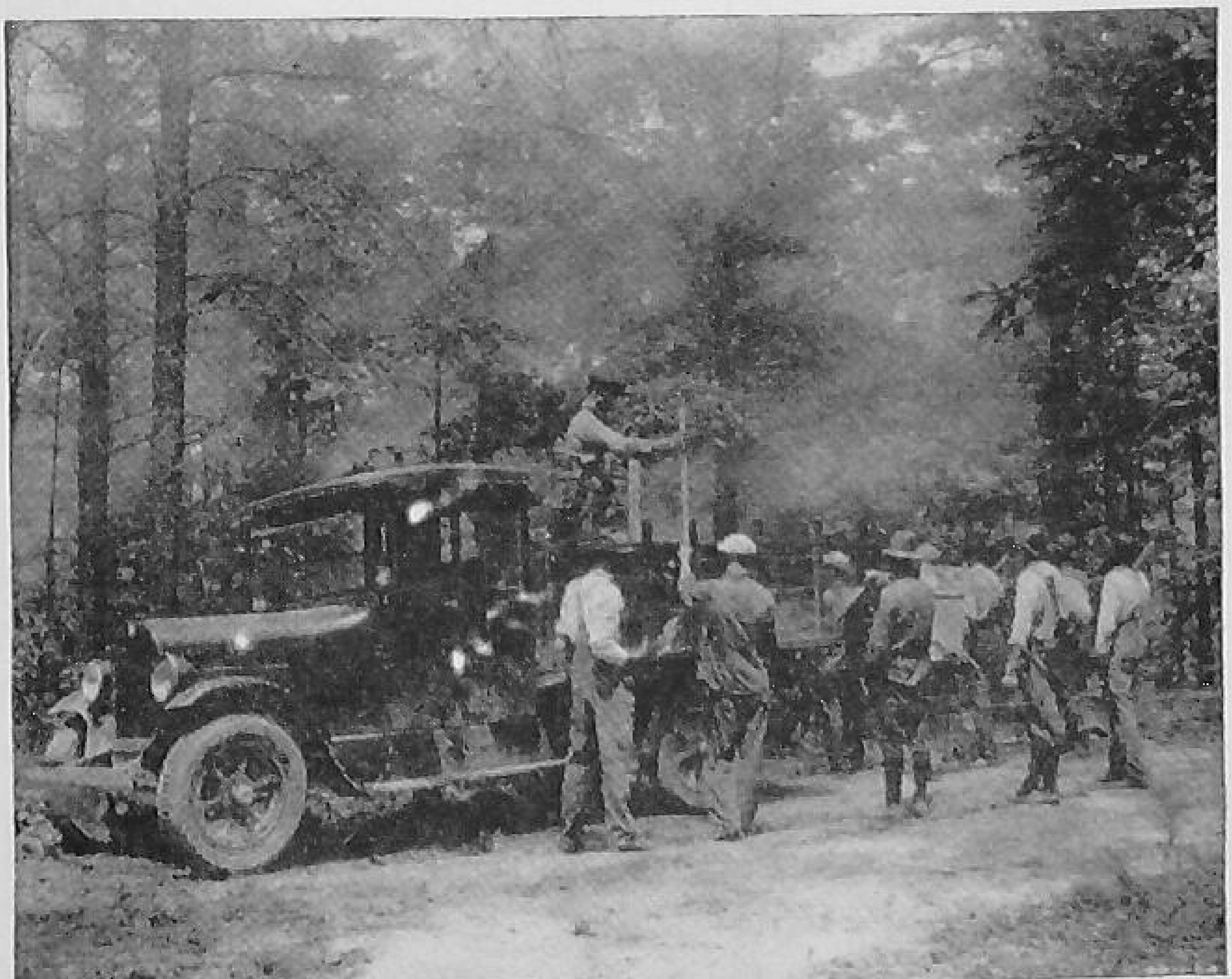


The Radio and Telephone Help Protect Our Forests

Radio and telephone are used in fire protection by the U. S. Forest Service. This scene shows the interior of the dispatcher's office at the Tellico Ranger Station on the Cherokee National Forest. The dispatcher keeps in constant contact with all fire towers, fire trucks, and rangers by means of radio and telephone. A fire alarm from one of the lookout towers puts the fire crew into immediate action

"This is one of the forest protector's jobs," said the old ranger. "A man lives in this house during fire season, watching the hills and valleys for a sign of smoke. He has a map on the table and an instrument called an *alidade* to help him in locating the fire. When he sees evidence of a fire, he calculates the direction and distance from the tower, looks at his map and attempts to determine the exact location. He then phones the ranger station and gives his report.

"After receiving the call from his lookout, the chief ranger calls one or more lookouts from which an ob-



Courtesy U. S. Forest Service

A FIRE-FIGHTING CREW

Already much of the forest land of the nation is being protected from fire under the stimulus of the Clarke-McNary Act. The time must come, however, in the South when fire protection must be provided as a service of county government if we are to stop the great losses now occurring in many parts of this section of the country

server should be able to see the smoke of the fire. A compass reading and distance estimate is taken from each of those stations. When two or more compass bearings have been secured, the ranger then turns to his map where each station is located. The bearings are read from two or more of the stations on his map and the point where the lines cross indicates the exact location of the fire. This method is known as triangulation. Where two compass points and bearings are known, the third point may be easily located.

"After the location of the fire is known, the remainder of the fire fighting organization is called into action. Men may be at work building houses, or roads, or trails, but whatever they are doing, they drop it immediately and concentrate upon fighting that fire until it is completely out, or what is known in the best fire-fighting circles as 'black out.'

"As I told you there are three kinds of forest fires. One is the *crown fire*, which we seldom have in the South because the tops of the trees do not burn as easily in this country as they do in the North or West. This kind is perhaps the most spectacular and most disastrous of forest fires. It destroys millions of dollars worth of property and timber each year. Often entire towns are wiped out by the roaring blast, and sometimes lives are lost. Such fires travel with the speed of an express train and the heat from them extends two or three thousand feet into the air.

"Our usual fire in the South is the *surface fire*, which laps at the needles and leaves and grass and burns only the dead vegetation which grows close or has fallen on the ground. Sometimes the leaves of a tree twenty or thirty feet from the ground have a scorched appearance, and you might think the fire had burned through them, but this is only a result of the heat from the flames."

"What is the other kind of fire?" John asked.

The old ranger waved his hand, patiently.

"I was coming to that. It is the *ground fire*, that burns under ground and remains hidden. Sometimes it will burn for days after the fire fighters think all the

Courtesy Southern Region U. S. Forest Service

A PORTABLE PUMP

A forest worker using the modern fire-fighting equipment now available for suppressing forest fires

fire has been put out. Then it will appear as a surface fire and all the work of suppressing it must be done again. The ground fire is especially dangerous in low, swampy places that have dried out. I have seen it burn under the surface for days at a time, creeping along in the peat or dry bog with not a sign of smoke visible, only to appear again, even after a heavy rain.

"The methods used in suppression depend entirely on what kind of fire the fighters find when they reach the scene. If the fire is roaring, burning so hot and so high that the fighters cannot get close to it, they begin work several hundred yards from the fire line and make a fire break by scraping back the leaves and litter on the forest floor. This line parallels the fire. As the fire break progresses, men are left behind to patrol it, to see that the fire does not jump across the break. Sometimes these flames are so hot and so certain to jump the newly constructed line, that fire is set along the inside of the fire line and allowed to burn to meet the oncoming fire. This method is called back-firing. Fire burning against the wind is not nearly so hot as one that burns with the wind behind it."

The ranger paused and looked out across the blue expanse of distance.

"Do you know why fires that burn uphill are so hot?" he asked.

"Is it any hotter burning uphill than down?" John countered.

The ranger nodded.

"Indeed it is. Flames create their own draft in this manner: The fire heats the air. Hot air rises. There must be air in the place vacated by the hot air, because nature abhors a vacuum, so cold air rushes in from below and the flames are fanned to greater intensity. Usually, on a hot fire line, where the fire is burning up a slope, the fire fighters make a line on top of the ridge and try to hold the fire there. Sometimes they are not successful, for a high wind will blow burning embers half a mile or more. Where they fall, a new fire will start."

"Do you ever anticipate fires," John asked, "or prepare to fight them before they start?"

The ranger turned to a large map on the wall. With his gnarled finger, he pointed out a system of telephone lines which ran from one section of the forest to the other. The map showed where ranger stations, lookout houses and fire suppression crews were located, so that a fire starting on any part of the forest could be reached in an hour's time.

"That is not all," he said. "We are continuously carrying on a program of what is known as *fire pre-suppression.* We tack posters warning the motorist and camper against setting fire, maliciously or accidently. We try to make personal contact with almost all people who come into the forest, to tell them to be careful with matches and cigarettes. When we have a dangerous season, no one can start a fire in the woods for any reason without written permission from the ranger and then only in specified places. No one is even allowed to smoke when the forest floor is perilously dry. In addition, we have lookout men in these towers day and night, watching for the first sign of smoke.

"As I said, some states have very strict laws about forest fires. In portions of the country men may be conscripted from the city streets by either state or federal officials and made to go fight forest fires. A few years ago two young friends of mine visited the West. They stopped to spend the night in a small California town. Hearing that a forest fire was raging on one of the mountains nearby, one of the boys climbed into his car and went up to see it. He was put to work with an ax, making fire breaks, but was fed and given a place to sleep during rest periods. The next day the other lad went up to find the first. He, too, was put to work. Both were released two weeks later, after the fire was completely out, and paid a dollar a day for their services.

"Uncle Sam realizes just what a forest fire in his woods means. Each one of those fires costs him a good many dollars an acre and he has found it much cheaper to spend a few cents an acre in the first place and protect his trees and forests by presuppression rather than by actual suppression."

John Coulter learned many more things that day. The lookout man whose tower they had climbed kept a pack sack filled with fire-fighting tools by his bed side. He was always ready, at a minute's notice, to swing that sack of tools to his shoulder and go down the ridge or into the cove to form the first line of defense until help came. The old ranger opened the pack sack and showed John the tools. It contained an ax, a mattock, and a short-handled fire rake with sharp teeth. A blanket was tucked snugly away in one corner, for the nights in the mountains are cold and an exhausted man, who has battled flames for a day and night, might easily become sick sleeping in his wet clothes on the ground. It also contained a two-day supply of emergency rations, a first aid kit, a canteen and a number of small incidentals.

"That is not all the equipment we have for fighting fires," the ranger said. "We once fought fires with less, but the past few years have seen the development of much new fire-fighting equipment. Someone, for instance, has invented a metal water tank, with a pump, nozzle and straps so that it may be carried on the back of a man to the fire. A double nozzle which will allow a full stream of water or a fine spray can beat down almost any type of fire. The tanks come in two sizes, five and seven gallons and may be easily filled at any stream.

"Recently a new pump has been developed to throw as much water as a city fire department. This pump

is placed by a stream or lake and will push water through the hose as far as half a mile into the woods. This pump is especially adapted for fighting hot, dan-

Courtesy Southern Region U. S. Forest Service

FIRE-FIGHTING EQUIPMENT

Showing a portable radio and pump

gerous fires that might take a life when we have to throw a cordon of men around it."

He pointed to the old-fashioned wall telephone.

"We are doing away with that," he said. "We have experimented and found that short wave radio is much better than telephones. Radios are now so inexpensive that we can buy sets which are so simple to operate that the men of the forest can talk to each other and to headquarters. When you take into consideration that so much wire, so many poles, and so much labor are necessary to install a telephone system, radios cost very little more to install and operate than did the old-fashioned telephone.

"A small radio set which now is available is mounted in a box and equipped with straps so that the average patrolman can carry it to the fire line, where it can be set up in a few minutes. By use of this portable radio set, the progress of the fire can be reported to headquarters."

"You have been talking about fire prevention and fire fighting in national forests and on property owned by the Federal Government," commented John. "That is fine, but what can the average landowner do to prevent fires? What protection is available to him?"

Controlling Fires on Private Lands

"The state forestry departments made provisions for that," said the ranger, "with the help of some federal aid. Back in 1925, two men in Congress put their heads together, and with the aid of others interested, passed what is known as the Clarke-McNary Law. This national legislation sets up money to be spent on private land, where the owner is interested and joins in the common cause of preventing fires on private forest lands."

"A number of landowners, with an aggregate of more

than ten thousand acres of land, meet and pledge themselves to do all possible to protect their lands from forest fire. They form an organization, elect a president, a secretary, and a treasurer. Usually one of the officers has charge of the patrolmen, keeps the records, and is paid for his services. Patrolmen are selected, towers erected, and telephone lines put up much the same as in National Forests. Fire breaks are built, and here, more than in any other organization, all types of fire breaks are made. The kind of forest usually determines the type. Where the country is inaccessible, truck trails, or narrow roads are made to allow fire fighters to reach any part of the property in trucks. In flat, open forest, the fire breaks are plowed, either behind a tractor or mules. In rocky, hilly country, the fire breaks are cleared and scraped of their leaves and debris. Sometimes two strips are plowed and the land between them burned. This is done where wide fire breaks are required.

"You May Build a Fire—But Be Careful"

A forest officer issuing campfire permits to a party of hikers

"The breaks are always laid out to take advantage of every natural fire barrier, such as roads which are already in existence, streams, open fields and other barriers over which fire will not burn.

"For every dollar the organization spends on paying the salaries of patrolmen, of putting in telephones or towers, or making fire breaks, the state forest service refunds one-half to the organization to go back into the pockets of the landowners. In other words, for every dollar the landowner spends, the state and federal services match it with another dollar to help him protect his land. In the South there are now well over a hundred million acres of forest land under this kind of protection."

It was nearly dark when John and the ranger left the lookout tower. John felt that it had been an interesting and a profitable trip for it had given him a new appreciation of the importance of forest fires and the elaborate plans that have been made for their prevention on lands owned by the Federal government. He had also learned how Timber Protective Organizations may be formed and partially financed among private landowners.

Organized Fire Control Units.—Every state in the South, through its state forest service, is now engaged in forest fire prevention and control work. Laws have been passed, programs have been developed, funds have been provided, and educational campaigns are being conducted. Funds for helping organized units are available. An example of the amount and character of this assistance is indicated in the following quotation from a publication of the Florida Forest Service:

Organized Forest Fire Control Units

"The Florida Forest Service offers three types of cooperation to landowners and counties that are interested in preventing and controlling fires that might lay waste their forest lands.

Individual Agreement

"Where the landowner or resident manager lives on the property and has sufficient labor to fight all fires adequately, and pay three cents an acre a year, which is matched by a similar amount from State and Federal funds, fire lines are plowed, hand and power fire-fighting equipment is purchased and, on areas large enough to provide the funds from the co-operative budget, towers and telephone lines are erected, towermen are employed to detect fires, and the services of a ranger are available to assist the landowners in organizing and training fire-fighting crews, taking charge of law-enforcement cases, and carrying on educational work to prevent fires.

Group Units

"This method of protection is available to those individuals or groups of landowners, owning 30,000 acres or more, who do not have manpower available, or are otherwise unable to protect their lands without our assistance. In these cases, the owners pay from five to eight cents an acre a year which is matched by three cents of State and Federal funds. The same improvement and equipment are provided as outlined for the *Individual Agreement.* The Florida Forest Service, however, employs a ranger who is responsible for organizing and directing the fire prevention and control work.

County Cooperation

"Boards of County Commissioners can now hold referendum elections of the people to decide whether they want to establish counties, or parts of counties, as fire control units. The State and counties cooperate on a 50–50 basis up to a specified limit, when State and Federal funds are available. The work is conducted in a similar manner to that described under the *Group Unit* plan."

It will be seen that in this state plan there is an opportunity for every landowner to get protection for his forest land. Protection is available to (1) the individ-

ual landowner, (2) the community, and (3) the county.
When the voluntary protective units were first organized, it was a distinctly forward step. Great progress in fire prevention has been made since that time. It

Courtesy Southern Region U. S. Forest Service

YOUNG TREES GROW RAPIDLY WHEN PROTECTED FROM FIRE

will continue to serve as a means of reducing fire losses in the South and elsewhere. But there is a growing conviction in the minds of those best informed that we are moving in the direction of county fire control.

Government aid is provided so that citizens working together may enjoy services which they cannot afford as individuals. We have agreed upon certain of these services, such as police protection, the building of roads, and the operation of schools. On account of our inability as individuals to control forest fires, and because of the importance of protecting our forest resources in the interests of public welfare, it is only a matter of time in the counties with the largest forest interests when fire protection will be available as one division of county government.

How Everyone May Help.—It is the duty of every good citizen to help protect the natural resources of the community, state, and nation in which he lives. Cooperation by the individual citizen is a necessary part of any program of conservation.

What are some of the things that all of us can do to prevent forest fires?

Help Prevent Woods Fires

1. We can BE CAREFUL with fire.
2. We can BE SURE a match is out before throwing it away.
3. We can NEVER throw away burning tobacco.
4. We can CHOOSE a safe place to make a camp fire.
5. We can MAKE A SMALL FIRE when cooking in the woods.
6. We can PUT OUT camp fires with water and then cover the spot with earth.
7. We can NEVER start a fire on a windy day.

8. We can learn NOT TO BURN large brush piles.
9. We can CREATE A SENTIMENT for fire prevention.
10. We can STUDY about fire losses and learn the damage that is done by fire.

These are a few of the things that all of us can do to prevent fires. But above all other things we can create an attitude toward CONSERVATION that will do more than anything else to prevent fires. We can, if we will all try, make everyone realize that it is his duty as a citizen to help protect the natural resources so that all may enjoy them and be enriched through their preservation.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What damage do repeated fires do to old trees? Explain how trees are exposed to insects and diseases as a result of forest fires.
2. What per cent of the forest area of your state is burned over each year? What is the estimated annual damage?
3. Do fires damage mature pine forests? If so, in what way? What happens to young trees and tree seeds in forests that are burned over each year?
4. Why do trees grow slowly on land that is burned over each year? Why do forest fires increase erosion and floods?
5. How do forest fires start? Name five causes. By what cause are the greatest number of fires started in the South? What is meant by the term "Incendiary fires"?
6. What are forest lookout towers? What purpose do they serve?
7. Explain how forest fires are located from lookout towers. Can you explain why bearings from at least two towers must be made before a fire can be located accurately?

8. Name the different kinds of forest fires. Define each.
9. What is meant by *suppression? Presuppression?*
10. What are some things that may be done to prevent forest fires?
11. Name some of the fire-fighting tools. Explain the usual method of fighting a fire when the wind is blowing. What is meant by back firing?
12. How is the radio being used to combat forest fires?
13. For what purpose may Federal Funds under the Clarke-McNary Law be spent?
14. What are fire breaks? How are they constructed?
15. What is meant by a timber protection organization?
16. What three plans for aid in fire protection are provided by the Florida Forest Service to landowners? Explain the provision of each plan.
17. What are some of the things that all of us can do to prevent fires?
18. Do you think it is possible to create a different attitude toward fire prevention?
19. Why is forest fire prevention of more importance to the South than other sections of the country?
20. Do you think that turpentine operators should burn around their trees?
21. Do you think that forests should be burned to improve grazing?
22. Do you think that farmers should often have brush to burn?
23. Do you think that persons who set fire to the woods intentionally without any reason for doing so should be sent to prison or fined?
24. Do you think that counties should provide fire protection for forests, just as cities provide fire protection for homes?
25. Do you think that the South can reduce losses from forest fires so that they will be no greater than those in other parts of the country?

Selected References

U. S. Department of Agriculture, Washington, D. C.
Leaflet 40—Burning Woods in the South.

State Forest Service

Arkansas—Bulletin 5—The Unburned Woods.

Florida—Woods Fires Everyman's Enemy. Florida Manual for High Schools.

Georgia—Leaflet 7—Why Prevent Woods Fires.

Kentucky—Bulletin 3—Forest Warden's Manual.

Oklahoma—Publication 12—Forest Fires—A Menace to Oklahoma's Woodlands.

Tennessee—Circular 14—Forest Fires in Tennessee.

Virginia—Publication 42—The Destruction Caused by Forest Fires (Charlottesville, Va.)

Suggested Activities

1. Write to your State Forest Service and ask for any bulletins that are available dealing with forest fires and ask for information that will enable you to answer the following questions: (1) What forest laws do you have in your State pertaining to fire prevention and control? (2) What plan does your State have in cooperating with landowners in preventing and controlling forest fires? (3) What were the extent of the fire losses in your State last year?
2. Write to the U. S. Forest Service (Washington or Atlanta) and ask for any available publications dealing with forest fires in the South. Also ask how your State compares with others in the same region in fire control.
3. If possible make a trip into the woods for the purpose of observing all the damage done by fire. Record all your observations in your notebook and discuss them in class after the field trip.
4. If any member of the class has visited a National Forest and has observed the efforts made to prevent fires, ask

this pupil to make a talk to the class about his observations.

5. From your State Forest Service, or from the U. S. Forest Service, secure a motion picture film to be shown in the school which will tell the story of forest fire control.
6. If possible secure a forest fire warden or some other well-informed person to talk to the class about fire control. If not, interview a landowner to determine how fire is controlled on his land. Have the class make out a list of questions in advance which will be asked the person interviewed.
7. Have several members of the class make reports on all the literature they are able to secure which deals with the control of forest fires.
8. Using the figures for fire losses in your State given in the table in this chapter, determine how many acres of land might have been protected from fire with this sum if Florida Plan No. 1, *Individual Agreement*, had been followed.
9. Write a short paper on the subject: *Why We Should Control Forest Fires in the South.*
10. Make a list of all the ways that forest fires may be prevented.
11. Make a poster for the purpose of teaching others to help with fire prevention. After the posters are made they may be hung in the school rooms, or in other places where many people will see them.
12. If you have a school forest, conduct an experiment to determine how fires reduce the growth of trees. This can be done by dividing a given area into two parts of equal size. On one of them fire will be kept out; the other will be burned over each year. Notations will be made and kept from year to year showing the results in the rate of growth in the trees and in other characteristics related to the value of the trees.

CHAPTER 16

FOREST INSECTS AND DISEASES

PRIOR to 1905, millions of acres in the eastern part of the United States were covered with magnificent chestnut trees. They, more than any other species, dominated the forest stand of the Appalachian Mountains from the New England States to Georgia. This species had more uses than any other tree in the sections where it grew. Chestnut trees, apparently, had the greatest promise of any species in the region. This was because they grew fast, were adapted to a wide range of conditions, and reproduced abundantly.

Today the chestnut is rapidly becoming extinct. Only in isolated places may living specimens be found. In its native region, where once the species reigned supreme, healthy trees no longer exist. Those that remain are ghost-like specters that mar the landscape. They have died by the millions!

The chestnut has been the victim of a disease—chestnut blight!

The efforts of science to conquer the blight or arrest its devastating spread have proved futile. Apparently, the only hope to prevent the species from becoming entirely extinct is that some individual trees will prove blight resistant.

The disease causing the destruction of chestnut trees was first discovered in this country in New York City in 1904. The parasitic fungus that causes the disease

was brought to the United States from Asia. This was before plant quarantine laws had been enacted.

From New York City, the disease spread rapidly through the New England States and South along the Blue Ridge and Allegheny Mountains. By 1935, practically all of the chestnut trees in the Appalachian highland extending into the South had been infected and killed.

The disease spread rapidly because the fungus spores causing the disease were often carried great distances beyond the infected area by birds, winds, and other agencies.

When the spores that cause the blight come in contact with the trunk and branches of a chestnut tree, they immediately start a growth that eventually destroys the bark and cambium layer. This interferes with the flow of sap, and, as a result, the tree dies.

Fungous Diseases.—Many different kinds of fungi attack trees causing trunks and limbs to decay. This decay is especially noticeable where trees are scarred as the result of fire or other injury. You have doubtless seen many trees with hollow trunks. These hollows which often render a tree unfit for use as lumber are caused from fungi. In fact, all tree diseases are caused by some species of fungi.

Fungi are plants. They live on food substances contained in other living or dead plants. They do not take their food from the soil as trees do. Those that live on dead trees or plants are called *saprophytes*. Those that take their food from living trees or plants are known as *parasites*. Fungi produce spores that are equivalent to the seed of ordinary plants. When the spores lodge in a favorable spot, they soon develop into fungous plants.

Dutch Elm Disease.—This is another disease that

was brought to America from a foreign land. The Dutch Elm Disease, so named because it was first identified in Holland, was introduced from Europe. It threatens to destroy one of the most graceful of American trees, the elm.

Since 1919, it has spread throughout central Europe and has killed millions of elms. The disease was discovered in the United States in 1930.

In England, as well as other parts of Europe, hope for its eradication has been abandoned. The following is a discouraging statement from the representative of the United States Department of Agriculture at Oxford, England, regarding the efforts to control the disease in Europe:

"After eighteen years of unsuccessful efforts to fight the disease which threatened her elms, Europe has decided to give up an aggressive campaign as far as eradication is concerned. Europe has found it began its work too late. It intends to continue only the normal processes for forestry practice, and let the beetle reap its inevitable harvest. It can only be a few years until all the elms of England and the Continent are gone."

The Dutch Elm Disease is caused by a fungus that is carried from tree to tree by bark-boring beetles. The fungus interferes with the normal sap flow of a tree.

Around New York City and in a few other local areas an effort is being made to check the spread of the disease and to destroy all infected trees. Federal, state and local governments have already spent millions of dollars in an effort to wipe out the disease in infested areas. If these efforts are successful the spread of the disease will be prevented.

This tree disease has not as yet reached the South although the various species of elms native to the South are susceptible to it.

Rust Canker Disease.—The four principal species of southern pines, longleaf, slash, loblolly, and shortleaf are subject to infection by what is known as the Rust Canker Disease. Scrub oaks are known to be infected by the fungus that causes the disease. It spreads from oaks to the pines.

Nursery stock is subject to infection. Studies by the Southern Forest Experiment Station show that nursery beds that are located a distance of 1300 feet from scrub oaks and away from pine trees with the Rust Canker Disease are not likely to become infected. Nursery stock that is infected should be destroyed.

On branches or trunks of trees that are attacked, enlarged knots or cankers form. From these, several branches or shoots usually appear. These cankers, of course, check growth and are likely, when a seedling is attacked, to cause a deformed tree with two or three trunks.

Imported Diseases.—The diseases of trees that have caused the greatest damage in the United States have been introduced from other countries. Native trees have built up no resistance to the diseases that were brought in from foreign lands.

The White Pine Blister Rust is another example of a disease brought to the United States from a foreign land. It was introduced from Europe in 1900. Since then it has killed millions of white pine trees.

In recent years quarantine laws have been passed which if rigidly enforced will doubtless prevent the introduction of other diseases and insects harmful to trees.

Insects Cause Great Damage.—The damage done each year by tree insects runs into millions of dollars. Some experts claim they do greater damage to forests than fire or any other agency. According to the Bureau of Entomology of the United States Department of Agri-

culture, the insects that are classified as *tree killing bark beetles* destroy annually more than 6,000,000,000 board feet of timber valued at from fifteen to twenty million dollars. Much of the damage done by insects is not spectacular, like that caused by fires or storms, and thus goes unnoticed.

There are literally thousands of different insects that attack trees. The damage done by the great majority of these insects is of minor importance. Usually effective control measures cost more than the timber destroyed is worth.

Most insects and diseases prey on the weaker trees. The best insurance against damage from these enemies of the forest is to keep the trees healthy. Fire damaged trees are a constant prey to insects and diseases. Diseased and damaged trees should be removed from the stand. Removal of diseased trees prevents the spread of diseases and insects to the healthy trees.

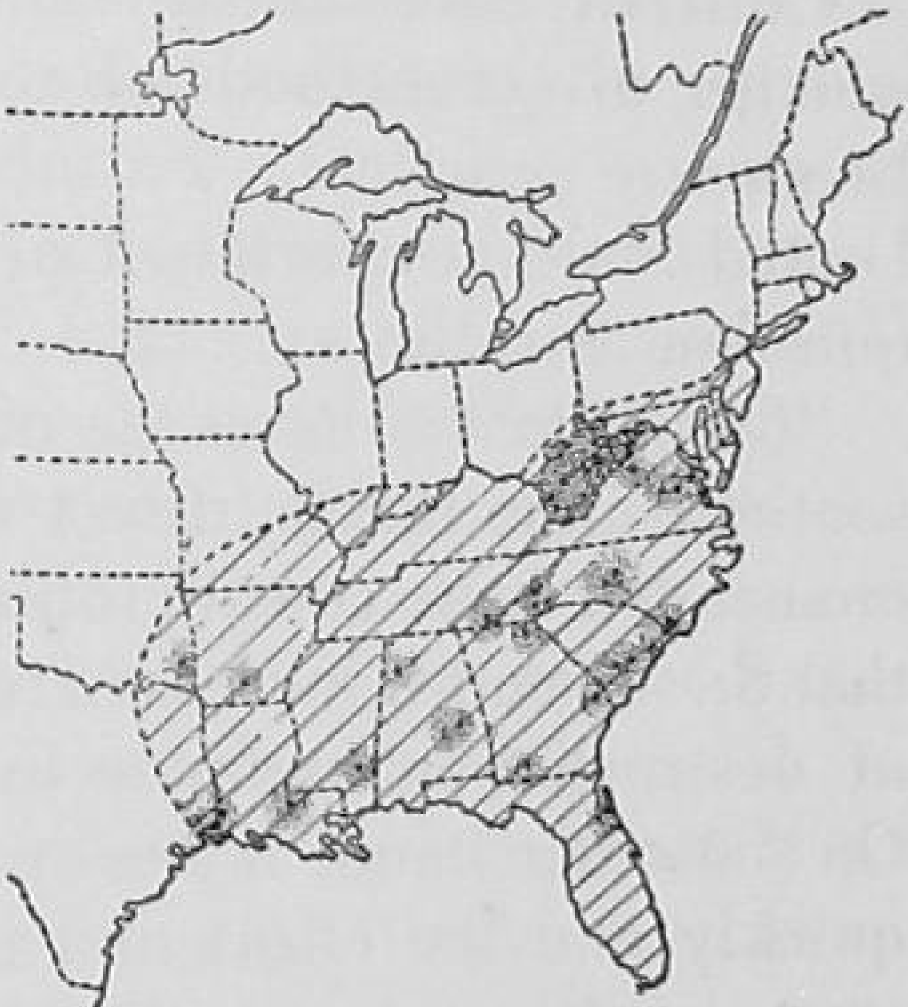
Trees that have fallen to the ground as a result of storms or other causes should be utilized at once. If they are allowed to remain in the forest for any length of time, pine sawyers and other borers will soon render them unfit for lumber.

Southern Pine Beetle.—The insect that has caused the greatest damage in southern forests is the Southern Pine Beetle. The seriousness of this pest is pointed out in the statements that follow from Farmers' Bulletin Number 1586:

"There is probably no more serious enemy of pines in the Southern States than this beetle. It attacks and kills healthy, vigorous pines of all species occurring within its range, including those of practically all ages. Extended observations in the Southern States since 1891 have led forest entomologists to place the present stumpage value of pine killed during this time at no less than

$50,000,000. The value of timber killed by this beetle, during a single epidemic in the South Atlantic and Gulf States in the years 1908 to 1911, inclusive, has been placed at $2,000,000. In 1922 and 1923 extensive outbreaks of this beetle were again reported or observed, and a vast quantity of good timber was known to have been killed. Later outbreaks took place in 1925, 1926, and 1927. It is well known that only a comparatively small percentage of the destroyed pine was ever salvaged after these epidemics. There is constant danger that the beetle status may again rise to the danger point.

"No part of the South is free from this bark beetle. Its outbreaks occur periodically throughout the States of Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Tennessee, Kentucky, South Carolina, North Carolina, Virginia, West Virginia, Maryland, and Delaware."



From F. B. No. 1586

Map Showing the Distribution of the Southern Pine Beetle

Outbreaks of this insect usually follow long dry spells which weaken trees and decrease the sap flow. Dry weather, apparently, is favorable for the development of broods of beetles in countless hordes. If pine trees are cut in the summer, the tops and limbs should be removed or piled and burned. Outbreaks of the beetle have been known to occur where fresh cut tops of pines were allowed to remain among growing trees.

It is usually easy to distinguish damage done by the

Southern Pine Tree Beetle. The beetles usually bore into the middle or upper trunk of a tree. About ten days after the tree has been attacked, the needles turn a yellowish green color that is noticeable at a great distance. Later the foliage will change to a reddish brown. Often when heavy infestations occur particles of ground-up fibre similar to sawdust may be found beneath the trees that have been killed.

Control Measures.—There is some doubt as to whether direct methods of control of the Southern Pine Beetle are practical. Farmers' Bulletin Number 1586, United States Department of Agriculture discusses this question as follows:

"Owing to the influence of weather conditions on the southern pine beetle, direct methods of control are recommended with considerable hesitation. It is evident that these beetles increase from a status of rarity to that of destructive abundance in a remarkably short time. On the other hand, if heavy rains come they disappear quickly and the effort and money spent in control are wasted. It seems reasonable, however, to believe that if the situation were taken in hand at the outset and the insects thoroughly and persistently destroyed, it would be impossible for them to increase as rapidly as if nothing had been done, and considerable timber would thus be saved.

"In such control the main objective is to *destroy the broods developing in the bark of the tree,* thus preventing them from emerging as beetles and destroying other living trees. This can be accomplished by one or another of the following methods:

"(1) Felling and logging infested trees and removing the logs to a sawmill, the logs being immediately sawed and slabs burned. This method is especially recommended where practical, since it permits salvage of the

lumber which otherwise would be rapidly destroyed by borers and timber beetles.

"(2) Felling and limbing infested trees in a north-and-south direction; after they have lain in this position a few days, turn them completely over. This measure is effective only in a well exposed sunny situation during midsummer. The insects under the bark on the exposed side of the log are all killed after about three days of hot sun. The logs must be turned so that the broods under the bark on the opposite side will be exposed to the sun and killed.

"(3) Felling and barking infested trees and burning the bark and tops. This method is dangerous in the summer unless extreme precaution is taken to avoid fire. It is, however, a practical control measure in winter."

If the foliage has turned brown the insects have already abandoned the tree. The beetles in deserting a tree leave many small shot-like holes in the bark. Foliage of trees containing live insects are often only slightly faded.

Since beetles are attracted to scorched trees, keeping fire out of forest stands will help to reduce the damage of this pest.

Classified List Of Insects.—Below are listed a few of the more important forest insects of the South. They are arranged in groups according to the type of damage done by each. For further information regarding any of these insects see Miscellaneous Publication, 74, United States Department of Agriculture.

Important Forest Insects

I. *Tree-Killing Bark Beetles.*

1. Southern Pine Beetle.
2. Red Turpentine Beetle.
3. Black Turpentine Beetle.

4. Ips or Engraver Beetles (several species).
5. Hickory Bark Beetle.

II. *Insects Boring in Living Trees.*

1. Turpentine Borer.
2. Locust Borer.

III. *Insects Affecting Forest Products.*

1. The Columbian Timber Beetle.
2. Pine Sawyers (several species).
3. Red-headed Ash Borer.
4. Pole Borer.
5. Termites.

IV. *Insects Affecting Seeds, Forest Reproduction, and Nursery Plants.*

1. Nut Weevils.
2. Cone Beetles.
3. Acorn Gall Makers.
4. European Pine-shoot Moth.

V. *Defoliating Insects.*

1. Grape Colospis.
2. Catalpa Sphinx.
3. Tent Caterpillars (several species).
4. Gypsy Moth (New England States).
5. Tip Moth.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Tell what has happened to the chestnut trees.
2. Where was the chestnut blight first discovered in this

country? From what continent did it come? Why was it impossible to stop its spread?

3. What causes trunks and limbs of trees to decay?
4. What is fungus? What are the two kinds of fungi? What are spores?
5. When was the Dutch Elm Disease discovered in the United States? What is the extent of its spread in this country? What success have European countries had in controlling this disease? Can you name the species of elms in the South that are susceptible to this disease?
6. What species of trees are susceptible to the Rust Canker Disease? How may infection from this disease be prevented in nursery beds?
7. Can you explain why diseases that have been introduced from other countries are so destructive to native trees? Why are diseases and insects less likely to be introduced into the United States today than formerly?
8. To what extent do insects damage trees in the United States? Why is it that more effective control measures are not put to use? Tell some things that may be done to lessen the damage done by insects and diseases.
9. What insect has caused the greatest damage in Southern forests? What is the value of timber destroyed by this insect since 1891? In what states do outbreaks of this insect occur? What influence does weather have on outbreaks? What precaution should be taken if timber is cut in the summer? Tell how to distinguish damage done by Southern pine tree beetle. Why are direct methods of control of this insect questionable? Tell of the three methods of control suggested by the United States Forest Service.
10. Name ten of the more important forest insects of the South. How are they classified? Name the groups into which they are divided.

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Southern Forest Experiment Station

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Suggested Activities

1. If you live in a region native to chestnut trees, determine from the class members the number of living chestnut trees in the community. Also, the number still standing that are dead.
2. Have each pupil bring to class a specimen of fungus. Compare the difference in the various kinds.
3. Take class on trip into near-by forest or woodland. Have them report on the following observations:
   (a) Number of evidences found of insect injury to trees.
   (b) Nature of injury.
   (c) Report on the same observations regarding diseases.

4. Write to the United States Forest Service, Washington, D. C. for the latest information regarding the spread and control of the Dutch Elm Disease.

5. Write to your state forester for information as to the extent of damage done in your state by the Southern Pine Tree Beetle. Also ask for information regarding other insects and diseases that damage trees in your state.

UNIT VI—FOREST MANAGEMENT

CHAPTER 17

FOREST MANAGEMENT

NATURE strives eternally for perfection. Strong animals prey upon weaker ones. One species attacks another. Large fish always follow in the wake of "schools" of little fish. Insects of one sort are often sought to exterminate those more objectionable to man.

Strange as it may seem, trees also continually fight for existence. When a great tree in the forest dies or is cut down, dozens of others spring into existence to take the place of the giant that occupied a prominent place in the sun. All these little trees compete for plant food and sunshine. One, in a favored position, succeeds, shading out those not so fortunate. As a result, most of the little trees never grow large; they are doomed forever to a mere existence, if indeed they are able to live at all.

Trees Classified.—Trees are classified on the basis of the progress they make in this struggle for perfection.

The tallest and largest of the trees, with great crowns spread out to the sunlight, are known to foresters as *dominant* trees. These are the trees which dominate the forest. In most cases these trees are more valuable than any others.

The next group of trees are known as those which are *co-dominant*. This means that they are excellent trees,

almost as large and strong as those in the dominant class. In fact, they may be cut for lumber at the same time as the dominant trees.

The third group, known as the *intermediate* trees, have a hard struggle. They are able to send only a few branches into the canopy where the life-giving sunlight is abundant. Such trees are always ready to take the places of the stronger ones, should they be removed.

Last, and least fortunate of all the trees, are those known as belonging to the *suppressed* class. These unfortunate trees never get enough sunlight, water, and plant food to amount to anything. They are like the "runts" sometimes found in litters of pigs.

Not long ago a class of agricultural pupils examined the difference between a dominant tree and a suppressed tree growing side by side in the forest. The dominant tree was a beautiful thing to behold, symmetrical, huge, with a trunk diameter of over twenty inches. The suppressed tree, growing under the shade of this forest monarch, was a pitiful object. Its leaves, which received insufficient sunlight, were yellowish in contrast to the rich, bright green of the leaves of the tree growing above it. Its bark did not look healthy and its trunk had the appearance of growing this way and that, as if undecided which was its most successful path toward the sun. The diameter measurement of its trunk was less than six inches.

Increment, or growth, readings were taken of the two trees. To take increment readings, the boys used a hollow steel tube with threads on one end. Foresters know this instrument as an *increment borer*. To make growth readings the tube is twisted into the heart of the tree and removed with a long, wooden pith, on which the annual rings are marked. By counting the rings on this pencil-shaped pith, the boys were able to tell the

age of the tree. The health of the tree was in no way impaired by this examination.

Imagine the surprise of the class when they learned that both the trees were exactly the same age.

Thinning or Improvement Cutting.—Man may assist Nature in the struggle for perfection by thinning

Courtesy Southern Region U. S. Forest Service

A Good Stand of Pines, Properly Thinned

the trees. This is called forest thinning or improvement cutting. By having too many trees in a given area, the growth rates of all are retarded. The fewer trees that remain after thinning will make more total growth than the larger number if unmolested in their struggle for existence.

Let us begin by considering the situation in a mature stand. The dominant trees will be almost as large as they are going to grow. They are ripe and ready for the market. Their life span has been lived and soon

they will become weakened and crash to the forest floor, where they will be useless to man. In this instance suppose the forester or lumberman goes into the woods with his saw and ax and removes the largest trees, being careful not to take away too many lest the moisture content of the forest floor will be dried by the winds and the sun. The remaining trees, many of which have been fighting for existence since they sprouted from seeds, having new room for root systems and new space for crowns then take a new lease on life. They immediately begin to expand to take the places of the monarchs which have been removed from the forest stand. In a few years they, too, will be giants and ready for the ax. This method of harvesting is known to loggers as the *selective* system of cutting.

Let us select another condition of the forest, where the species are mixed, where there are some large, some small, and many medium-size trees. In order to improve this stand, the forester concentrates on certain types of trees. First he removes the *wolf-trees*, those trees with top-heavy limbs, which spread out and take up a great deal of crown space. The branches may extend almost to the ground, making the lumber knotty and of inferior quality. Second, he selects the undesirable species or *weed trees*, which will never make good lumber no matter how large and straight they grow. Third, the crooked, knotty and diseased trees fall before his ax. The result is usually a mixed stand of medium-size, clean-trunked trees, which in time will produce valuable lumber.

A third typical condition is a stand of small trees, just starting out in life. The stand is crowded. Several thousand trees grow on each acre of ground—far too many for rapid growth into a good forest stand. The problem of the forester here is to remove those trees

which will be detrimental to the stand as a whole. The smallest, weakest and suppressed trees are removed. The largest and the ones most properly spaced are allowed to stand. The result is a rapid growth and a good stand.

Pruning.—It is profitable in many cases to prune the lower limbs of young trees. This is especially true of pines. Pruning should be done when the trees are three or four inches in diameter. It may be repeated every five years. If trees are pruned up to sixteen feet in height, or until fifteen years of age, the slower process of natural pruning will be eliminated.

According to studies that have been made, pruning improves the grade of lumber from ten to thirty-three per cent. This is because lumber from trees that have been pruned is free of knots. Pruning too early or too severely is likely to retard growth by reducing the amount of leaf surface, which, as you know, is required for the growth functions.

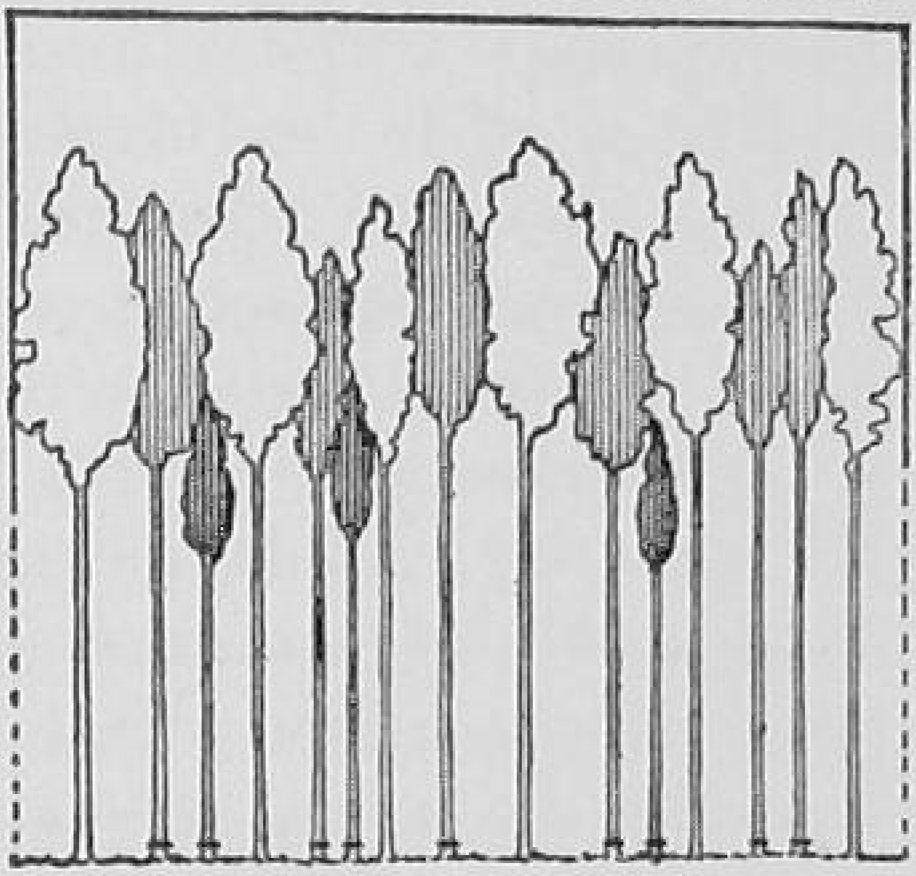
Other Management Problems.—Thinning is only one of many forestry management problems. Forest management is called *silviculture*, which means culture of the forest. It may, perhaps, best be explained by a simple illustration. Suppose you owned 5,000 acres of pine forest on the Florida-Alabama line where study had revealed that fifty years was required for a pine to grow into a lumber tree measuring from twenty to thirty inches in diameter. Suppose further that you wanted to manage your forest in such a manner that it would bring in a revenue for you and your sons and your sons' sons, as long as your family existed on the face of the earth. What would you do?

The most simple method would be to mark off your five thousand acres into fifty plots, one hundred acres to each plot. An excellent, well kept stand of timber

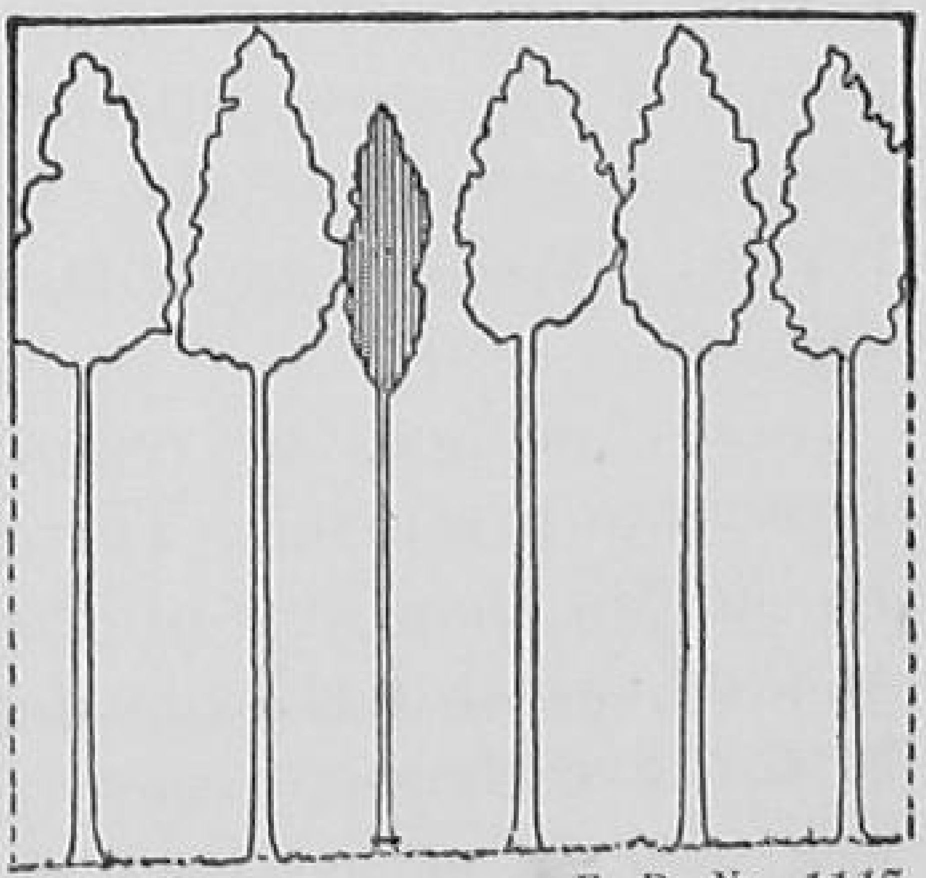
in south Alabama or northern Florida will produce twenty thousand board feet to the acre, more or less. To be conservative let us work on the basis of ten thousand board feet per acre. Each one hundred acres would yield one million board feet of lumber.

First-class lumber brings from twenty to thirty dollars dressed and dimension timbers up to seventy-five dollars per thousand, which means that the average gross income per annum from the sawmill and the five thousand acres should be not less than a hundred and not more than three hundred seventy-five dollars per acre. The one hundred acres should yield at least twenty-five thousand dollars. After the cost of taxes, logging, sawing, and replanting is subtracted, the total remaining should be at least ten thousand dollars per year. That would be a pretty good income for any family.

After the first plot is cut over, let it be replanted and allowed to



Before Thinning—Fifteen Crowded Trees



F. B. No. 1117

Six Years after Thinning—One Tree to Be Cut

Pine trees should be thinned as often as necessary. The trees that are cut out can be used, or sold for firewood, posts, pulpwood, or other purposes. After thinning, pines grow three times as fast as in the usual unthinned stand

grow until all the other plots are cut. If one plot is cut each year, then the lumberman would get back to his first plot after fifty years and find the timber ready for harvesting.

That is what the foresters mean when they say that the five thousand acres has been placed on a *sustained yield basis*. But let us study the plan from another angle. Day in and day out a small portable sawmill will cut an average of five thousand board feet of lumber per day. This means that approximately eight months will be consumed in removing the timber from one hundred acres. That allows four months for replanting the area, removing the cordwood and by-products from the lumber making operation.

Occasionally seed trees are left and the land is allowed to restock itself. Although that method of securing a new stand of trees is cheaper than any other, it is not the most satisfactory. Natural reseeding is uncertain at best and the experts have found that a more perfect stand can be obtained through artificial reforestation.

Many methods of removing lumber trees from the forest are practiced. Three methods, perhaps, are better known than any of the others. The *clear-cutting method*, which has been described as being applicable to the five thousand acre tract, is one. In following this method, as has been shown, all trees are removed from a certain prescribed area.

The method which follows the clear-cutting method most closely, perhaps, is the *strip method*. The forest is laid off in strips, or bands of forest trees, and every other strip is logged. This method is especially desirable where artificial reforestation is not practiced. The strips which are cut clean usually, in time, reproduce excellent stands of fine young trees. When

these have grown large enough to produce seeds, the strip which was left untouched the first time is logged.

Under the *selection* method of logging, the mature trees are removed and those which are still growing rapidly are allowed to stand. There are several varia-

TIMBER IS A FARM CROP

Farmers who practice good forest management in their woodlands get a continuous crop of wood or timber from them and always leave a stand to produce more and protect and improve the soil instead of cutting the land over and leaving an almost worthless devastated area. This farmer is following a crop tree method of woodland management. The best trees of desirable species have been marked as crop trees and the others, including the crooked and diseased ones, will be cut out as needed

tions of this plan of cutting, but all are designed to produce the largest possible amount of wood on a sustained yield plan in contrast to the destructive plan of cutting all the trees on a given area, as has too often been the practice in the past.

Good forest management looks upon trees as a crop,

just as any other crop grown by a farmer or landowner. It looks upon a great forest as something that will last forever, not something to be completely destroyed in a short time. It looks upon such work as is being done at Crossett, Arkansas, as ideal. Of the work of the Crossett Lumber Company, the Times-Picayune said: "They have made a wilderness burst into industry; they have contributed to the world an ideal town; they have assured employment for a thousand men and their children to come after them; they are helping to build the South as it should be built—permanent, contented, prosperous." This is good forest management, and an example of the benefits to be derived from it.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by the statement—Nature strives for perfection? Give a number of examples.
2. Explain how trees compete with each other.
3. What do trees need for rapid growth?
4. Why is Nature's method of reforestation wasteful? How is it inefficient?
5. How can man aid Nature in bringing trees to perfection?
6. What is meant by forest thinning?
7. Explain why trees need thinning.
8. What is meant by tree pruning? When should it be done? Why is it desirable?
9. What trees should be thinned out?
10. What is meant by a *dominant* tree? What other groups of trees are there in this same classification? Describe each.
11. What are some forest management problems other than thinning? How and why are they important?
12. What is meant by the term *sustained yield?*

13. What are some of the plans under which a sustained yield may be obtained?
14. What is meant by *strip cutting?* By *selective cutting?*
15. Give an example of the value of thinning. Of sustained yield cutting.
16. What is an increment borer? How is it used? Explain.
17. What are some of the results that may accrue from good forest management?

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Suggested Activities

1. Carry the class into the forest on a field trip for the purpose of (1) classifying trees according to the *dominant* and other types of trees, and noting the differences in size and shape, etc., and (2) for the purpose of studying the thinning problem in the case of young trees. On the same trip note wolf and weed trees.
2. Give a demonstration in the thinning of a stand of young pines, marking those which should be cut, giving the reasons in each case for the trees selected.
3. Give a demonstration of the proper method of pruning a pine tree.
4. Make observations in the forests of the community of thinned and unthinned stands for the purpose of determining the rate of growth under the two conditions.

Chapter 18

ESTIMATING STANDING TIMBER

TIMBERLAND owners in the South have lost millions of dollars by failing to secure full value for standing timber. They have incurred a large part of their losses as the result of underestimating the volume of timber on tracts of land. Those who purchase trees on the stump usually have a better knowledge of how to determine the amount and value of timber in a stand than do the woodland owners. In some instances, however, purchasers have lost money in over-estimating the volume of timber.

It is essential in determining the value of the trees on an area of land to know the amount of lumber that may be cut from it. Without this information no reasonable value can be placed on the products to be harvested.

Every farmer and woodland owner should know how to estimate standing timber. You, no doubt, know some man who has sold a farm, a part of which was covered with an excellent stand of trees, and who learned a short time after selling the property that the purchaser had marketed enough timber from the woodland to pay for the entire farm. Such incidents have happened many times. One who knows how to measure timber on the stump would not be likely to make such an unwise sale. If you are planning to buy a farm you should know how to determine the volume of the timber on the

land. The amount and kind of timber on a farm are important factors in estimating its value.

Determining the Value of Trees on Stump.—The value of trees on the stump, or the sale value of standing timber, may be determined by subtracting the

AN ITINERANT SAWMILL

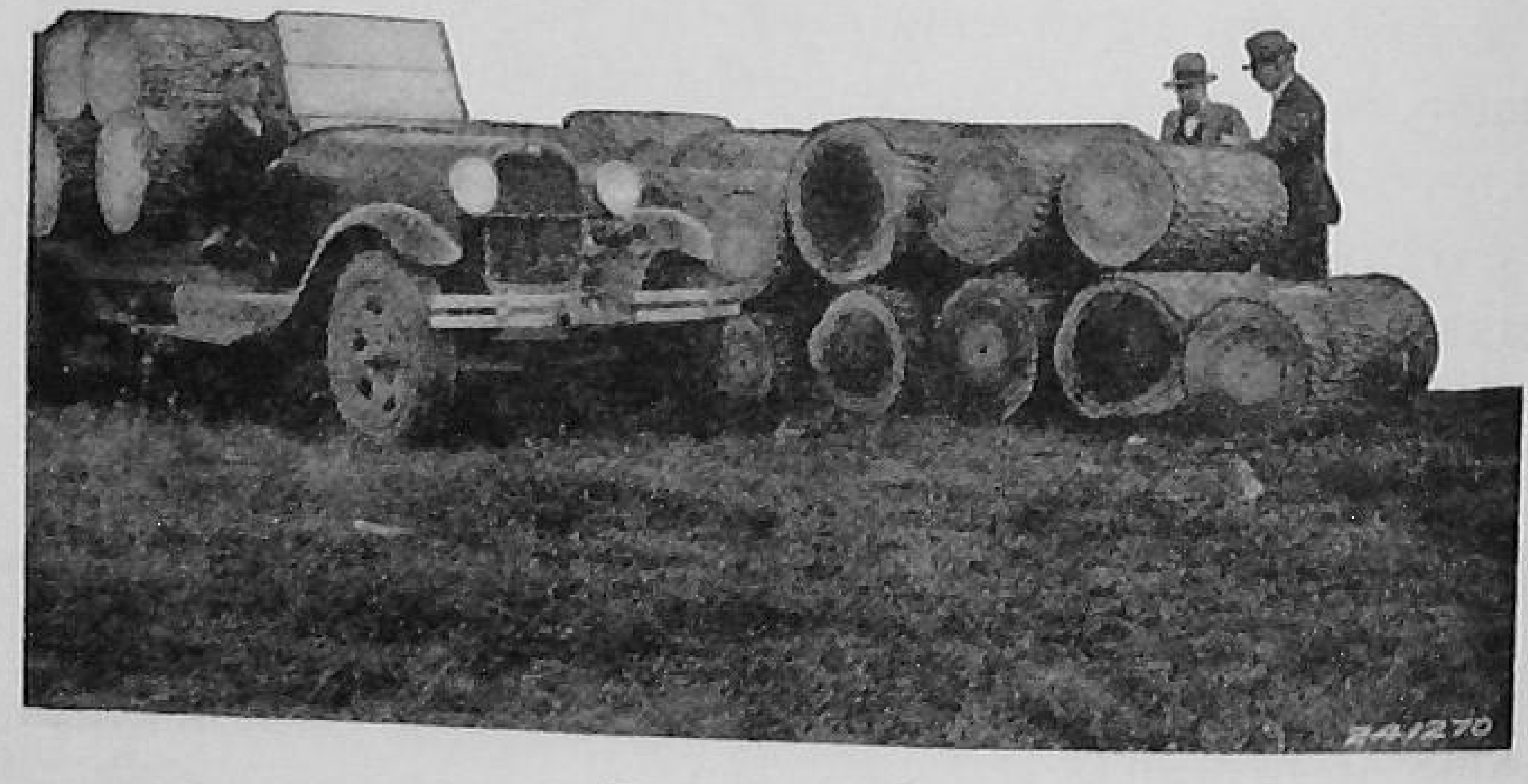
There are thousands upon thousands of small sawmills that move from place to place throughout the South in search of saw timber. Very seldom are the operators of such mills interested in progressive forest policies. The landowner who sells standing timber should designate in his contract what trees are to be cut

cost of harvesting and marketing the product from its current market value. If products are sold on the stump, the purchaser should be allowed a reasonable profit amounting from fifteen to twenty-five per cent on his investment in equipment, labor, and timber. Thus, in order for a person to intelligently market his trees on

the stump or determine their value it is necessary for him to have a knowledge of (1) the current price of forest products, (2) the cost of harvesting and marketing, and (3) the volume of timber on a tract of land.

Market value of timber products — cost of harvesting and marketing = stumpage value of timber.

The current price can usually be obtained through local dealers and from others of the community who have recently sold timber products. The value of the timber should be computed on the highest possible re-



VENEER BOLTS

A wise landowner knows the price of the products he has to sell; veneer bolts usually sell for more than sawlogs

turn. Timber converted into one product may not sell for as high a price as when converted into another. It is important to know what products will bring the highest current price. For example, certain timber from an area may sell for more if converted into heavy construction timber than if sawed into six inch boards.

In determining the cost of harvesting and marketing timber it is necessary to take into consideration the cost

of labor, accessibility of tracts of timber, distance from market, and condition of roads. The cost of harvesting is greatly increased if the forest stand is located in an isolated mountain section or in a dense swamp. Timber in such places is not worth as much on the stump as it would be if it were more accessible. Poor roads leading to a forest stand increase the cost of hauling and for this reason decrease the value of the trees on the stump. In fact, anything that increases the cost of harvesting and marketing decreases proportionately the value of the standing timber.

First Step in Determining Stumpage Value.—The first step in determining the value of trees on the stump is that of estimating the standing timber. This is necessary before one can begin to figure the cost of harvesting and marketing. The volume to be harvested, hauled, and marketed must first be known. Likewise, it is essential to know the amount and kind of timber on a tract before much progress can be made in obtaining the value of products that the stand will produce. For example, let us suppose a stand is made up of slash, longleaf, and pond pines. To determine the current value of products from the tract it would be essential to know the approximate volume of each species. With the value of the products that a forest stand will produce the stumpage value can more accurately be determined.

Measurement Units.—There are several measurement units of timber. The products into which timber is made usually determines the unit of measurement. It is important to have a knowledge of the basic units in order to determine the value of timber.

Board Foot: Board foot is the unit of measure for lumber. It is equivalent to a board one inch thick and one foot square. A piece of lumber 1 inch thick, 12 inches wide and 10 feet long contains 10 board feet.

Courtesy U. S. Forest Service

If the tree scale, or cruiser's stick is held horizontally against the trunk of the tree at a specified distance from the eye, the observer is able to read directly the diameter of the tree outside the bark

To find, for example, the number of board feet in 1 piece of lumber 2 inches thick, 8 inches wide, and 12 feet long, figure it as follows:

$$\frac{1 \times 2 \times 8 \times 12}{12} = \frac{192}{12} = 16 \text{ Board Feet.}$$

Pieces of lumber that are less than an inch thick are usually counted as if they were an inch thick.

Cord: A cord contains 128 cubic feet, which is the space occupied by both air and wood. This unit is used in measuring wood for fuel. A standard cord is a pile of wood 4 feet wide, 4 feet high, and 8 feet long.

The actual cubic feet of wood in a cord varies. This variation occurs because the size and shape of the pieces of wood are not the same. A cord actually contains from 80 to 100 cubic feet of solid wood, which is only about 70 per cent of the total space (128 cubic feet) occupied by a cord. A cord contains about 500 board feet.

For pulpwood, trees are usually cut in lengths of 5 feet. Thus a cord 5 feet wide, 4 feet deep, and 8 feet long gives a gross measure of 160 cubic feet.

Piece: There are many kinds of wood products that are sold by the piece. Such products as poles, piling, posts, and crossties are sold by the piece. Some of these products are of standard dimensions, others are not.

Acreage: An acre of land contains 43,560 square feet. A plot 209 feet on all four sides makes almost an acre. Standing timber is sometimes sold by the acre. Timber for pulpwood is often bought on the stump by the acre.

Equipment for Estimating Standing Timber.—Methods have been developed so that with practice it is now possible to estimate fairly accurately the amount

Diameter of Tree Breast-High (inches)	No. of Trees of Each Size Required to Yield				Tie and Pole Product per Tree	
	1 Cord		1,000 Feet of Lumber		No. of Ties Hardwoods	Length of Pole Hardwoods (feet)
	Southern Hardwoods	Softwoods	Southern Hardwoods	Softwoods		
2	170	.....	.....	.....	.....	.....
3	90	.....	.....	.....	.....	.....
4	50	.....	.....	.....	.....	.....
5	25	.....	.....	.....	.....	.....
6	17	.....	.....	.....	.....	.....
7	13	20	.....	.....	.....	.....
8	9	13	.....	25	.....	.....
9	7	10	66	20	.....	.....
10	6	8	33	15	1	.....
11	5	7	22	10	1	.....
12	4	6	13	8	2	25
13	3.4	4.5	11	7	2	25
14	3.0	3.7	9	6	3.3	30
15	2.5	3.0	7	5	3.3	35
16	2.2	2.5	6	4	.....	40
17	2.0	2.1	5	3.1	.....	40
18	1.8	1.9	4.5	2.6	.....	45
19	1.5	1.6	4.0	2.4	.....	45
20	1.3	1.5	3.3	2.1	.....	45
21	1.2	1.4	3.0	1.8	.....	50
22	1.1	1.2	2.7	1.7	.....	55
23	1.0	1.1	2.5	1.6	.....	55
24	.9	1.0	2.2	1.5	.....	55

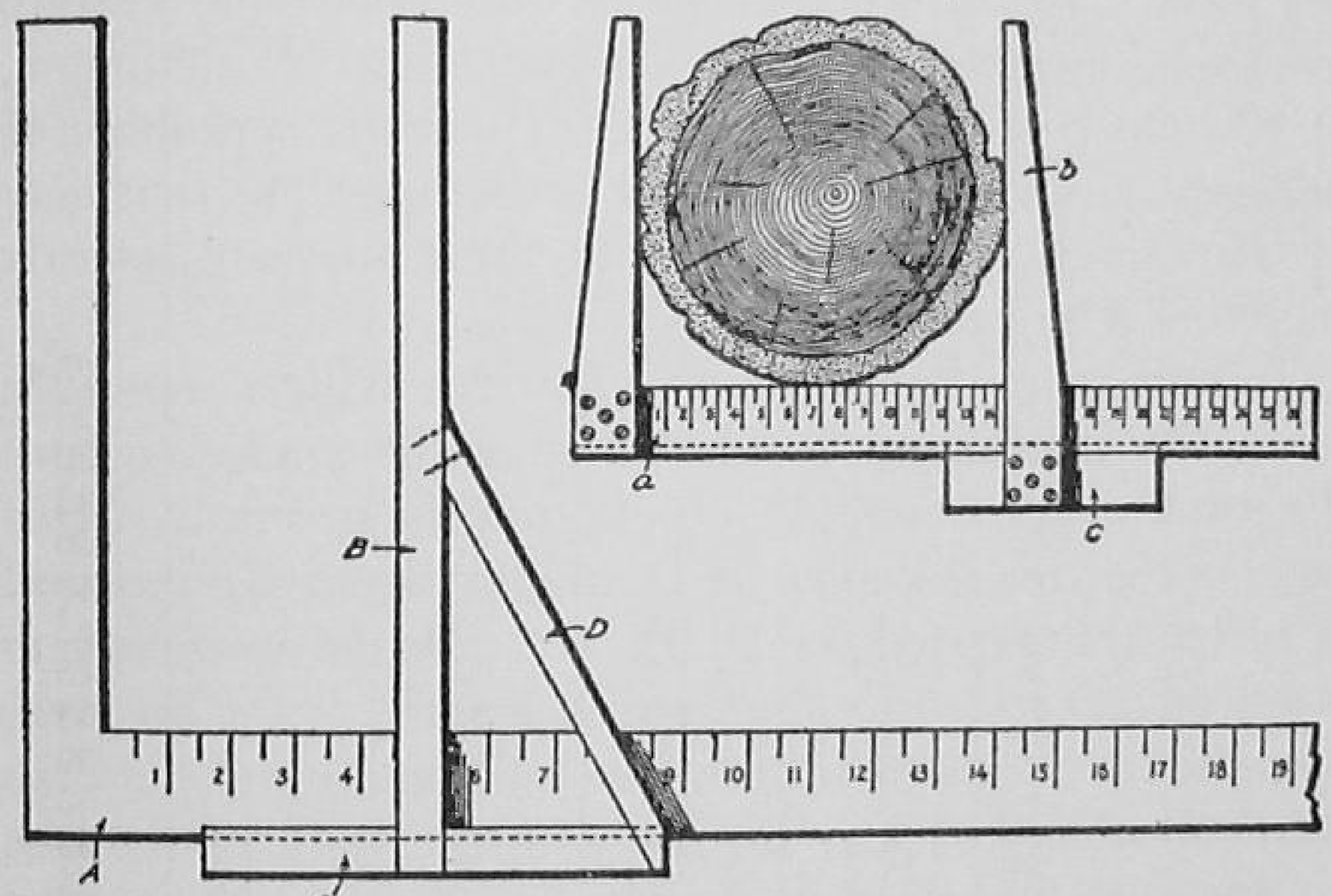
Courtesy of U. S. Dept. of Agriculture

1. For every thousand feet of lumber about ¾ of a cord of wood can also be cut from the tops.
2. For every ten ties about 1 cord of wood can also be cut from the tops.
3. For every 10 poles about 1 cord of wood may also be cut from the tops.

of standing timber on a tract of land. This job is known as *cruising*. It can be done with inexpensive equipment. Only instruments for measuring the diameter and height of trees are necessary. With the height and diameter of trees known their contents in board feet of lumber can easily be obtained.

Diameter Measurements.—There are several tools or instruments that may be used to measure the diameter

of trees. Calipers are commonly used. You can make one in a school or farm shop. A tree caliper is nothing more than a heavy measuring rule with two arms or projections attached at right angles. One of the arms is rigid and the other is made to slide back and forth. To measure the diameter of a tree with a caliper, the arms are placed snug on each side of the tree trunk.



Two patterns for simple homemade instruments, or calipers, for measuring the diameters of trees

The diameter may then be read on the graduated ruler.

A carpenter's square may be converted into a caliper by attaching a sliding bar to it. This can be done in a school or farm shop at little or no cost. Calipers made in this manner may be used for measuring trees 22 inches in diameter or less.

In measuring trees, if the trunk is not round, the shortest and longest diameters are added together and divided by two. This will give the average diameter.

Another instrument commonly used, especially by foresters, for getting the diameter of trees is the tree-scale stick. It is an instrument, having the appearance

of a yardstick, that may be used for determining both the diameter and height of standing trees. The height of trees is expressed in terms of 16-foot logs. On this stick is also given the amount of lumber trees of various dimensions will produce.

A complete set of tree-scale and log-scale sticks including a book of instructions and a cloth case for carrying them is distributed at cost as an educational feature by the American Forestry Association, Washington, D. C. The cost is $1.00 per set. There are a number of different kinds of tree-scales or cruising sticks that may be purchased. Directions as to their use are usually included with each set.

In measuring the diameter of a tree with a tree-scale stick, the instrument is placed at right angles against the trunk of the tree at 4½ feet from the ground. (This height on a tree is known as Diameter Breast Height and is often abbreviated as D. B. H.) It is necessary to stand off 25 inches, about arm's length, from the tree. The stick is adjusted on the tree so that in sighting, the zero end of the stick is in line with the bark of the tree on one side. Then, without turning the head one must sight across the stick on the other side and note the inch mark that is in line with the bark on the tree on the other side. This gives the diameter.

It is possible to secure the diameter of a tree through the use of a measuring tape. First the distance around the tree (the circumference) is measured. The distance in inches is then divided by 3.1416. It is sometimes necessary to use this method with trees that are too large to measure with other available instruments. If a tree is not fairly round, that is lopsided or oval-shaped, a fraction of the diameter obtained should be deducted.

Height Measurements.—In estimating the height of trees, any one of several devices may be used. Some

Courtesy U. S. Forest Service

The tree scale is graduated so that the observer who stands a specified distance from a tree can read the number of 16-foot-log lengths in the tree

of the instruments used for this purpose may be purchased at little cost and others may be made at home. The use of most of the measuring devices is simple and with them the approximate height of trees can be obtained quickly.

Included with those that may be purchased are instructions as to their use. Though they all work on more or less the same principle it is necessary to follow the instructions that accompany each.

The height of a tree is measured from 24 inches above ground up to where it tapers to five or six inches in diameter.

There are a number of tree-scale sticks that are commonly used to estimate the height of trees. With such a stick one may determine the number of 16-foot logs in a tree.

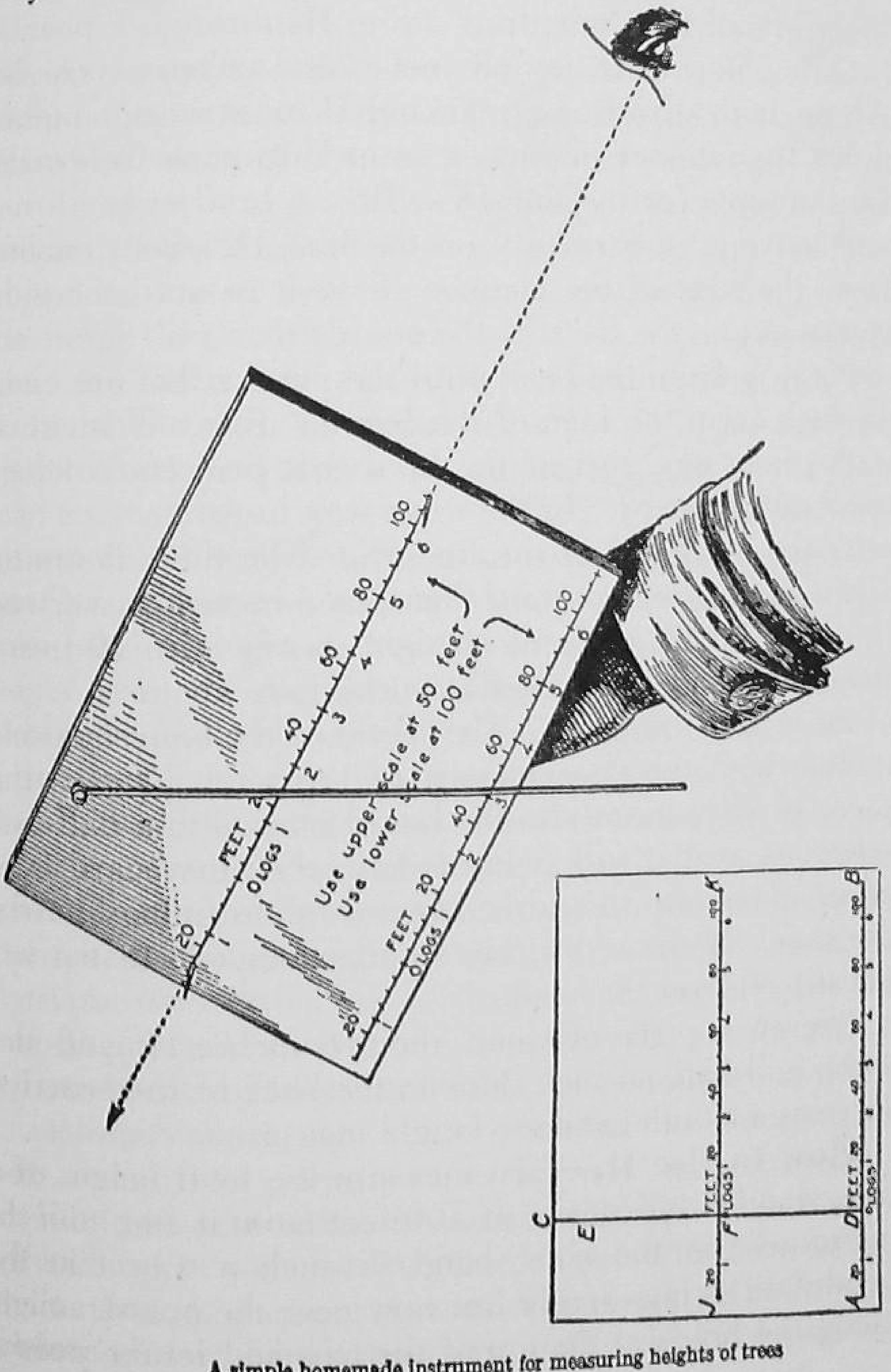
Tree-scale sticks also have printed on them the number of board feet of lumber contained in trees of various dimensions. The volume of trees may be estimated very rapidly with the aid of a tree-scale stick.

The United States Forest Service *Hypsometer* is one of the best instruments for estimating the height of a tree. It contains a graduated arc enclosed in a case. A small plumb bob registers the height of a tree. This is a rather simple device to use and is considered fairly accurate. There are other instruments on the market that may be used for measuring the height of trees, such as the *Merrit Hypsometer*, the *Abney Level*, and the *Christen Hypsometer*. Each of these devices carries instructions as to its use.

Homemade Device.—A simple instrument for measuring the height of trees or other standing objects can be made at home or in the school shop at practically no cost. The instructions for making such an instrument are listed below. They are reproduced from Farmers

Bulletin Number 1210, through courtesy of the U. S. Department of Agriculture.

How to Make It.—"Take a piece of half-inch board 7 by 9 inches and plane it smooth on all sides. Draw



A simple homemade instrument for measuring heights of trees

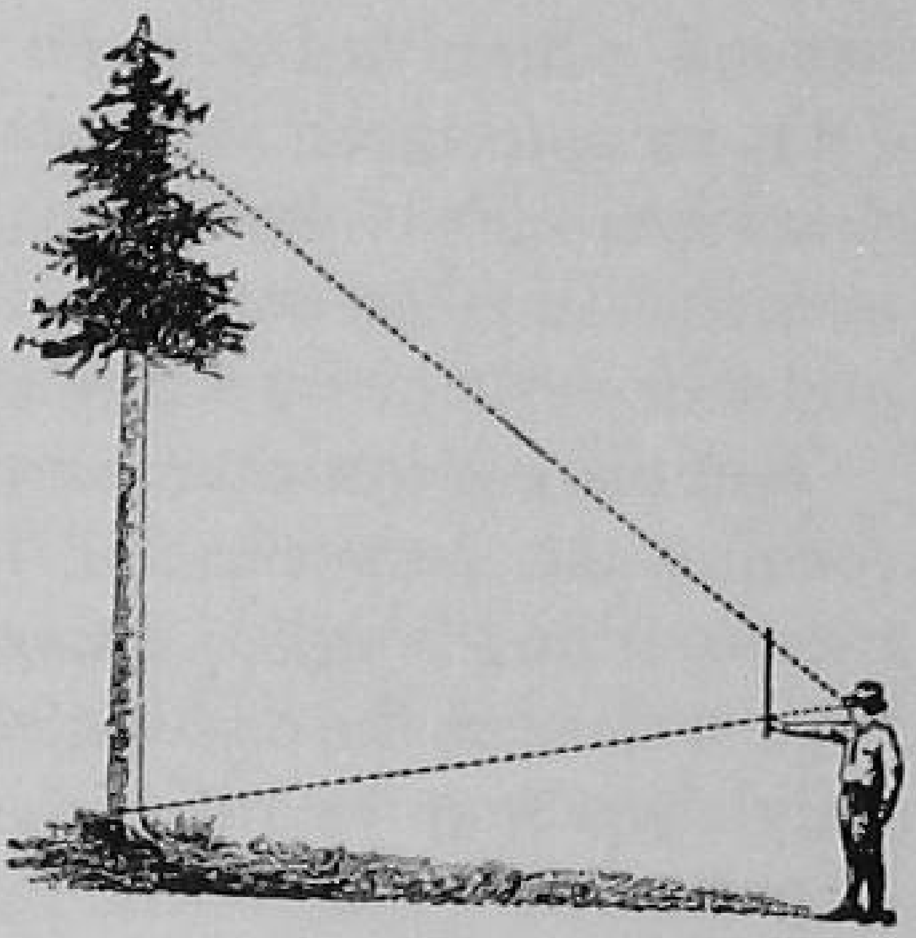
the line AB three-eighths of an inch from the lower edge and parallel to it. Two inches from the left end of the board draw CD at right angles to AB. Make a mark at E, $6\frac{1}{4}$ inches from D, and another at F, $3\frac{1}{8}$ inches from D. Now draw a line JK through F parallel to AB. Start at D, lay off inches and quarter inches on AB in both directions, marking D as zero and putting down the number of inches from D to each inch mark. Do the same for the line JK. Take a brad or small nail and drive it in carefully on the line JK about an inch from the edge of the board. Drive it in until the point comes out on the back of the board; then pull it out and drive it in from the back until the point sticks out about $\frac{1}{4}$ inch from the face of the board. File off or cut off with pliers any part of the brad that projects from the back of the board. In the same way insert another brad near the other end of the line JK. These brads are the sights, and it is important that they be straight and true.

"Now take a piece of straight, heavy wire 10 inches long and bend one end of it into a loop about an eighth of an inch in diameter. The center of the loop should be in line with the straight part of the wire. Fasten this piece of wire loosely to the board at E with a half-inch screw, so that it will swing freely when the board is on edge. The loop should be big enough to fit loosely over the shank of the screw, but small enough so that it will not slip off over the head.

"Screw a piece of wood about 6 inches long, 1 inch wide, and half an inch thick to the back of the board to serve as a handle, and the height measure is complete.

How to Use It.—"To measure the total height of a tree, stand at a distance of 100 feet from it and hold the instrument in the right hand in such a way that the pendulum swings freely but very near the board. Sight along the brads at the top of the tree and let the pendu-

lum come to rest. Then with the left hand press the pendulum against the board without giving it a chance to change its position. Now read off the number of feet in height on the lower scale. If the wire crosses the line 5 inches from the point D, it indicates that the tree is five 16-foot logs or 80 feet high above the level of the eye. Now sight at the foot of the tree and take another reading. If the pendulum hangs to the left of D, that is, between A and D, add the amount indicated to the first reading, and the result will be the total height of the tree. Thus, if it hangs half an inch to the left of D, add a log, or 8 feet, to the first reading, making a total of five and one-half logs, or 88 feet. But if the eye is below the foot of the tree, the wire will hang to the right of D (between D and B) and then the amount of the second reading should be subtracted from the amount of the first. Thus, if the first reading is 96 feet and the second is 12 feet (to the right of D) the total height of the tree will be 96 less 12, or 84 feet. If the tree is less than about 75 feet high, or if it is difficult to see the top at a distance of 100 feet, the observer should stand 50 feet from the tree but in this case the readings are on the line JK.



Measuring Height of Tree

"When the instrument is sighted the pendulum can be kept in position by tilting the hand slightly to the right. This brings the wire against the board and holds it in place so that a reading can be obtained. Care should be

taken, however, so that the wire will not slip after the board is tilted.

"In the example given, the total height of the tree has been measured. It is often of more practical importance to measure the height to a point on the tree beyond which there is no merchantable saw timber. This measurement is made in the same way as that described above, except that the instrument is pointed at what will be the top of the last log when the tree is cut, and then at the point where the top of the stump will be."

Keeping Diameter and Height Records.—In recording the diameter and height of trees as they are measured in the woods, it is necessary to use tally sheets. Such a sheet as the one suggested below may be used. A tally sheet may be ruled on any ordinary paper. It is important to separate the different species on the tally sheet. This is especially true if the stumpage prices are not the same.

SUGGESTED SHEET FOR TALLYING TREES WHEN VOLUME TABLES ARE AVAILABLE

A 2-Log Tree Is One That Will Produce Two 16-Foot Logs.

Diameter of Tree Breast-High (inches)	*Shortleaf Pine*				*Slash Pine*				*etc.*
	2-log	*3-log*	*4-log*	*5-log*	*2-log*	*3-log*	*4-log*	*5-log*	*1-log*
8									
9									
10									
Etc.									

The tally of the area estimated should show the total number of trees of each size and kind on the tract. From this information it is then very easy to calculate fairly accurately with the aid of the volume tables the total number of board feet of timber in a tract. It is also possible to determine the total volume of each species.

Methods of Measuring Standing Timber.—There are several ways of estimating standing timber. Some methods are more accurate than others. The method to be used should be determined by the equipment that a person has and his knowledge of how to use it. Two common methods of determining the volume of trees are (1) through the use of volume tables, (2) by the use of tree-scale sticks. The procedure to follow in the use of each of these methods is given below.

Use of Volume Tables.—To use volume tables it is necessary to know the diameter and height of each tree. Generally it is essential to have the trees classified as to species. With this information the volume of board feet in trees may be readily obtained.

The height of each tree is reduced to 16-foot logs. For example, a tree 48 feet high, measured from 24 inches above ground to where it tapers to five or six inches in diameter, would be reduced to three 16-foot logs.

Instruments and methods to use in getting the diameter and height of trees have already been discussed.

Volume tables give the approximate average number of board feet whole trunks of trees of different diameters and heights contain. Such tables are not accurate for determining the amount of timber in one or a small number of trees. They will give a fairly accurate total if applied to a large number of trees. Due to the fact that trees differ in shape even though they may be the

same height and have the same diameter, the contents will vary a great deal. So volume tables may show an error of from twenty-five to fifty per cent if applied to just one tree.

There are two volume tables given in this chapter; one is used as a general volume table for hardwoods or broadleaf species of trees and the other for softwoods or pine trees. You will note that corrections are given below each table so that accurate estimates for different species of trees may be made. For example, it is suggested that for shortleaf pines with diameters from ten inches and under, 15 per cent should be added to the volume listed in the table.

Suppose on an area the tally shows that there are twenty 3-log shortleaf pine trees, 18 inches in diameter. From the volume table for softwood trees you will find that a 3-log tree, 18 inches in diameter will produce 210 board feet. Multiplying 210 board feet, the amount in one 3-log tree, by twenty gives you 4,200 board feet.

From the correction note at the bottom of the table you will find that with shortleaf pine trees with diameters from 11 to 19 inches, it is necessary to add 25 per cent to the volume given in the table. Twenty-five per cent of 4,200 is 1,050. From these calculations you can see that twenty 3-log shortleaf pines, 18 inches diameter breast height, will produce 5,250 board feet of lumber.

From similar calculations the total volume of all the trees on the whole area may be found.

Estimating Timber with Tree-Scale Sticks.—Scale Sticks usually come in sets of two. One is used to estimate the number of board feet in a log and is called a log-scale stick. The other is used to estimate the volume of standing trees and is known as a tree-scale stick. There are several sets of timber scaling sticks on

Hardwood Volume Table

Amount of Saw Timber in Hardwood Trees of Different Diameters and Merchantable Heights

(Stump Height, 2 Feet. Trees Over 75 Years Old.)

Diameter of Tree, Breast-High (inches)	*Number of 16-Foot Logs*									*Diameter of Top (inside bark)*
	1	*1½*	*2*	*2½*	*3*	*3½*	*4*	*4½*	*5*	
	Volume—Board Feet									Inches
8	20	27	35	43	....	....	....	....	....	3
9	20	32	42	53	....	....	....	....	....	6
10	20	36	52	64	81	....	....	....	....	6
11	21	43	62	78	98	120	....	....	....	6
12	23	50	73	93	120	140	180	....	....	6
13	25	58	86	110	140	170	200	....	....	7
14	27	67	100	130	160	190	230	260	....	7
15	30	77	120	150	180	220	260	300	....	8
16	34	89	130	170	200	250	290	340	390	8
17	38	100	150	190	230	280	320	380	440	9
18	43	120	170	210	260	310	360	420	490	9
19	48	130	200	240	290	350	400	470	540	10
20	54	150	220	270	330	390	450	520	590	10
21	62	170	250	300	370	440	500	580	650	11
22	69	190	270	340	410	480	550	640	720	11
23	77	210	300	380	450	530	610	700	790	12
24	85	230	340	420	500	580	670	770	860	12
25	93	250	370	460	550	640	740	840	940	13
26	100	280	410	510	600	700	810	910	1,020	13
27	110	300	450	560	660	770	880	990	1,110	14
28	120	330	490	610	720	830	960	1,080	1,200	14
29	130	360	530	660	780	900	1,030	1,160	1,300	15
30	140	390	580	720	850	980	1,120	1,250	1,400	15
31	...	420	630	770	910	1,050	1,200	1,350	1,510	16
32	...	450	690	830	980	1,130	1,290	1,450	1,620	17
33	...	480	740	890	1,050	1,211	1,380	1,560	1,730	17
34	...	...	800	950	1,120	1,290	1,480	1,670	1,860	17
35	...	...	860	1,010	1,180	1,380	1,570	1,790	1,990	18
36	...	...	920	1,070	1,250	1,460	1,680	1,910	2,140	18
37	...	...	...	1,130	1,320	1,550	1,780	2,040	2,290	19
38	...	...	...	1,190	1,390	1,640	1,890	2,170	2,450	19
39	...	...	...	1,250	1,460	1,730	2,000	2,300	2,600	20
40	...	...	...	1,310	1,540	1,820	2,120	2,430	2,760	20
41	...	...	...	....	1,610	1,910	2,240	2,570	2,930	21
42	...	...	...	....	1,680	2,000	2,360	2,720	3,100	21
43	...	...	...	....	1,750	2,090	2,470	2,860	3,270	22
44	...	...	...	....	1,830	2,180	2,590	3,010	3,450	22

Correction factors for different species

Chestnut, for diameters from 8 to 40 inches, subtract 10 per cent. Chestnut oak, for diameters from 32 to 40 inches, add 10 per cent. White oak, for diameters from 18 to 40 inches, add 10 per cent. Other common hardwoods, for all diameters, use the table without change.

From F. B. No. 1210

Amount of Saw Timber in Softwood Trees (Pines, etc.) of Different Diameters and Merchantable Heights

(Stump Height, 2 Feet. Diameter (inside bark) of Tip, 6 Inches. Trees Over 75 Years Old.)

Diameter of Tree, Breast-High (inches)	Number of 16-Foot Logs						
	2	2½	3	3½	4	4½	5
	Volume (Board Feet)						
8	37	52	66	75	84	.....	.....
9	41	58	70	82	93	.....	.....
10	47	66	77	92	100	120	.....
11	53	74	86	100	120	140	.....
12	60	83	97	120	140	160	200
13	68	94	110	130	160	190	220
14	77	110	120	150	180	210	240
15	..	120	140	170	200	240	270
16	..	130	160	190	230	270	310
17	..	150	180	220	260	300	340
18	..	170	210	250	280	330	380
19	..	190	230	280	320	370	420
20	..	210	260	310	360	410	470
21	..	...	290	350	400	460	520
22	..	...	320	390	440	510	570
23	..	...	360	430	490	560	620
24	..	...	400	470	540	620	680
25	..	...	440	520	600	680	740
26	..	...	480	560	660	740	810
27	..	...	...	600	720	800	880
28	..	...	...	650	780	870	950
29	..	...	...	...	840	940	1,030
30	..	...	...	...	910	1,010	1,100
31	..	...	...	...	...	1,080	1,180
32	..	...	...	...	...	1,150	1,260
33	..	...	...	...	...	1,230	1,340
34	..	...	...	...	...	.....	1,420
35	..	...	...	...	...	.....	1,500
36	..	...	...	...	...	.....	1,580

Correction factors for different species

Hemlock:
For diameters from 8 to 10 inches, add 10 per cent.
For diameters from 11 to 20 inches, add 22 per cent.
For diameters from 21 inches and up, add 20 per cent.

Shortleaf pine:
For diameters from 10 inches and under, add 15 per cent.
For diameters from 11 to 19 inches, add 25 per cent.
For diameters from 20 to 23 inches, add 35 per cent.
For diameters from 24 inches and over, add 40 per cent.
White pine and other common conifers, for all diameters, use the table without change.

From F. B. No. 1210

the market. As previously stated, one such set may be obtained from the American Forestry Association.

Complete instructions as to their use accompany each set of sticks.

Probably the quickest and easiest method of estimating standing timber is through the use of a tree-scale stick. With such an instrument the height and diameter of a tree may be obtained. In addition to this, the stick has printed on it the board feet of timber contained in trees of various dimensions. With such an instrument one can estimate the volume of a tree in a few seconds.

The log-scale stick is also useful in determining the board feet contained in logs that are on the ground.

Estimating Timber without Volume Tables or Instruments.—Some men can estimate standing timber fairly accurately without the use of volume tables or instruments. Such men have gained their knowledge through years of experience. They are able to look at a tree and determine for all practical purposes its height, diameter, and the volume of timber it will produce.

The number of board feet of timber contained in trees of various dimensions has become well fixed in their minds. Only through years of experience can one expect to estimate trees with any degree of accuracy without volume tables or a tree-scale stick.

Per Cent of Area to Measure.—On small areas or where only a few trees are to be selected for sale every tree should be measured and the volume determined. On large areas it would take a long time and be rather expensive to determine the volume of timber in each tree. The usual practice is to measure all the trees on a certain percentage of the tract of land and from the figure obtained estimate the amount on the whole tract. For example, if the trees on one-fourth of the land are measured the amount of timber on this area would be

Courtesy Southern Region U. S. Forest Service

THE USE OF THE LOG-SCALE STICK

Determining the number of board feet in a log

multiplied by four to get the total volume on the whole tract.

When partial estimates are made the strip method is

often used. Where 25 per cent of the area is measured, the trees on a strip 66 feet wide are estimated from one side of the tract to the other. Similar parallel strips are taken, each being 264 feet apart. If one-half the area is to be surveyed, the distance from the center line of the strips should be 132 feet.

Estimating Cordwood.—In the South cordwood is usually sold for fuel or pulpwood. Tree trunks and branches two inches in diameter or above may be used as fuel wood. For pulpwood it should be four inches in diameter or more. Only timber that is small or that cannot be converted into more profitable products is sold as cordwood.

The tops of lumber trees are usually cut into cordwood. In general for every thousand board feet of hardwood lumber about three-fourths of a cord of wood can be obtained from the tops of the trees. Pines will produce about one-half cord to each thousand board feet of lumber.

If one already has an estimate of board feet on a tract of land the number of cords can be found by dividing the total board feet by 500. A cord of wood contains about 500 board feet.

On an area the remainder of wood suitable for cordwood may be roughly estimated by use of the table given below. The table gives the volume in cubic feet of 4-foot sticks with diameters from 2 to 12 inches. The diameters are estimated at the middle of each 4-foot stick.

Diameter of Stick (inches)	2	3	4	5	6	7	8	9	10	11	12
Solid contents (cubic feet)	0.1	0.2	0.3	0.5	0.8	1.1	1.4	1.8	2.2	2.6	3.1

Trees and branches must be laid off by eye in 4-foot lengths and the diameter at the middle of each length estimated. Calipers may be used to get the diameter of

the first 4-foot length on the trunk of a tree. This will help in estimating the diameter of lengths farther up the tree. By estimating the height of the tree the number of 4-foot lengths may be determined.

After tallying the 4-foot lengths of different diameters, by use of the table given above the total number of cubic feet of wood on the area may be determined. To reduce the cubic feet to cords it is necessary to divide by

Courtesy Southern Region U. S. Forest Service

SCALING LOGS CUT FROM A NATIONAL FOREST

90. This is true since a cord contains only about 90 cubic feet of solid wood.

Scaling Logs.—The number of board feet contained in a log may be obtained by use of a log-scale stick. Such an instrument has printed on it the number of board feet of lumber contained in logs of various diameters and lengths. It is also graduated in inches and feet and can thus be used to measure the diameter and length of a log.

The diameter of a log is taken inside the bark at the

INTERNATIONAL LOG RULE

(The Contents of Logs in Board Feet, by Using a Circular Saw, Cutting One-Fourth Inch Kerf, and Sawing Carefully by Good Methods)

Diameter of Log at Small End and Inside Bark (inches)	*Length of Log in Feet—*												
	8	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
4	2	2	3	3	4	5	5	5	6	7	7	8	9
5	4	5	6	7	7	8	9	11	12	13	15	16	17
6	7	9	10	11	13	14	16	18	19	21	23	25	27
7	12	14	15	17	19	21	24	26	28	31	34	36	39
8	16	19	21	24	27	30	33	36	39	42	46	49	52
9	23	26	29	33	36	40	43	47	51	55	59	63	68
10	29	33	37	42	45	51	54	59	64	69	75	82	89
11	36	42	46	52	57	63	68	74	80	86	95	100	107
12	44	51	57	62	70	77	83	91	97	103	111	119	129
13	52	60	68	76	83	92	100	108	116	124	134	143	151
14	62	71	80	98	107	107	117	127	136	147	158	168	176
15	73	82	94	104	114	125	136	146	157	170	181	195	204
16	84	96	108	119	131	144	156	167	181	194	207	222	233
17	96	110	123	136	149	163	177	192	205	221	235	251	265
18	110	124	139	155	169	185	201	218	232	250	267	282	300
19	123	140	156	175	190	210	225	244	261	280	299	317	337
20	138	157	174	197	212	232	251	270	290	310	330	352	374
21	152	172	193	215	234	256	279	299	321	344	366	389	412
22	168	192	214	238	259	282	307	330	354	379	404	429	453
23	186	212	235	260	285	310	337	362	388	415	445	470	498
24	203	232	257	285	311	339	367	398	424	452	484	514	543
25	223	253	281	311	339	370	400	433	452	494	526	560	590
26	241	273	304	337	368	402	435	468	502	537	570	606	640
27	262	296	329	364	400	434	471	504	543	580	617	657	692
28	281	319	356	395	432	470	509	545	586	623	664	706	748
29	303	344	383	425	463	505	546	587	630	670	712	756	801
30	326	369	411	455	498	542	586	628	674	719	765	810	858
31	348	397	442	488	532	582	628	670	724	771	819	868	918
32	373	424	471	520	570	621	672	718	773	821	874	927	979
33	397	452	503	557	608	662	715	766	822	877	929	988	1,042
34	423	481	534	592	647	702	760	818	876	932	990	1,052	1,109
35	450	509	567	627	685	747	805	872	930	992	1,050	1,117	1,176
36	477	540	599	662	727	790	853	920	884	1,052	1,114	1,184	1,244
37	503	570	635	702	767	835	906	974	1,042	1,109	1,178	1,251	1,317
38	532	603	672	742	811	880	954	1,028	1,098	1,174	1,245	1,320	1,388
39	561	635	710	783	858	932	1,004	1,082	1,158	1,237	1,312	1,289	1,467
40	594	671	749	823	902	983	1,059	1,139	1,126	1,300	1,381	1,462	1,543

Doyle Log Rule

Diameter of Log at Small End, Inside Bark (inches)	Length of Log in Feet												
	6	7	8	9	10	11	12	13	14	15	16	17	18
	Contents of Log in Board Feet												
6	1	2	2	2	2	3	3	3	3	4	4	4	4
7	3	4	4	5	5	6	7	7	8	8	9	10	10
8	6	7	8	9	10	11	12	13	14	15	16	17	18
9	9	11	12	14	16	17	19	20	22	23	25	27	28
10	13	16	18	20	22	25	27	29	31	34	36	38	40
11	18	21	24	28	31	34	37	40	43	46	49	52	55
12	24	28	32	36	40	44	48	52	56	60	64	68	72
13	30	35	40	46	51	56	61	66	71	76	81	86	91
14	37	44	50	56	62	69	75	81	87	94	100	106	112
15	45	53	60	68	76	83	91	98	106	113	121	129	136
16	54	63	72	81	90	99	108	117	126	135	144	153	162
17	63	74	84	95	106	116	127	137	148	158	169	180	190
18	73	86	98	110	122	135	147	159	171	184	196	208	220
19	84	98	112	127	141	155	169	183	197	211	225	239	253
20	96	112	128	144	160	176	192	208	224	240	256	272	288
21	108	126	144	163	181	199	217	235	253	271	289	307	325
22	121	142	162	182	202	225	243	263	283	304	324	344	364
23	135	158	180	303	226	248	271	293	316	338	361	384	406
24	150	175	200	225	250	275	300	325	350	375	400	425	450
25	165	193	220	248	276	303	331	358	386	413	441	469	496
26	181	212	242	272	302	333	363	393	423	454	484	514	544
27	198	231	264	298	331	364	397	430	463	496	529	562	595
28	216	252	288	324	360	396	432	468	504	540	576	612	648
29	234	273	312	352	391	430	469	508	547	586	625	664	702
30	253	296	338	380	422	465	507	549	591	634	676	718	760
31	273	319	364	410	456	501	547	592	638	683	729	775	820
32	294	343	392	441	490	539	588	636	686	735	784	833	882
33	315	358	420	473	526	578	631	683	736	788	841	894	946
34	337	394	450	506	562	619	675	731	787	844	900	956	1,012
35	360	420	480	541	601	661	721	781	841	901	961	1,021	1,081
36	384	448	512	576	640	704	768	832	896	960	1,024	1,088	1,152
37	408	476	544	613	681	749	817	885	953	1,021	1,089	1,157	1,225
38	433	506	578	650	722	795	867	939	1,011	1,084	1,156	1,228	1,300
39	459	536	612	689	766	842	919	995	1,072	1,148	1,225	1,302	1,378
40	486	567	648	729	810	891	972	1,053	1,134	1,215	1,296	1,377	1,458

small end. After the diameter and length of a log has been recorded it should be marked. This will prevent recording it twice.

If a scale stick is not available the logs can be measured with a yard stick, rule, or tape and the board feet determined from what is known as a log rule.

A table giving the approximate number of board feet of lumber that can be cut from logs of various diameters and lengths is called a log rule. There are a number of such log rules. The International and Doyle Log Rules are given on pages 373 and 374.

Yields given by different rules vary greatly. Some give much higher values than others. The Doyle Rule which is legal in several of the Southern states gives a very small yield for logs below 28 inches in diameter. It is not considered satisfactory for measuring the volume of small logs. When most of the timber was larger than that being sawed to-day, the Doyle rule was less objectionable.

"The International Rule," according to Farmers Bulletin Number 1210, "gives log volumes that are close to what can be sawed by using good methods. Owners of small logs for sale will benefit when this or some equally close rule has come into general use."

The following is a desirable form to use for recording dimensions and board feet contained in logs:

Log Number	*Length (feet)*	*Diameter (inches)*	*Scale (board feet)*
1			
2			
3			
4			
Etc.			

With a little study and practice any boy may learn how to estimate the value or worth of logs or standing timber.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Why is it important for timberland owners to know how to estimate standing timber?
2. What knowledge should one have in order to determine the value of a tract of standing timber? How may the current price of timber products be obtained?
3. What factors must be considered in determining the cost of harvesting and marketing timber?
4. What is the first step to be taken in determining the value of trees on the stump?
5. What are the units of measurement of timber?
   What is meant by board foot?
   How many cubic feet are there in a cord?
   How many cubic feet of solid wood are contained in a cord?
   Into what lengths are pieces of wood cut for pulpwood?
   Name some products that are sold by the piece.
   What kind of timber is often sold by the acre?
6. Name two instruments used for measuring the diameter of trees.
7. What is a tree-scale stick? How may the diameter of a tree be measured with a tree-scale stick?
   Tell how to secure the diameter of a tree by the use of a measuring tape.
8. Name three instruments that are used for measuring the height of trees.
9. In determining the height how much of a tree is measured?
10. What information is printed on a tree-scale stick?
11. Explain how to use the homemade device in estimating the height of a tree.
12. Name two common methods of determining the volume of trees.

13. How are diameters and heights recorded?
    Explain a simple method for tallying trees.
    What should a tally show?
14. What information do volume tables give?
    In order to use volume tables to determine the number of board feet of lumber, what information must be had of each tree?
    From the hardwood volume table determine the board feet of lumber contained in two trees each of which are 24 inches in diameter and contain four 16-foot logs.
    Are volume tables accurate in determining the volume of one or a small number of trees?
15. Explain the difference between a log-scale stick and a tree-scale stick.
16. Is it necessary to measure every tree in order to estimate the standing timber on an area?
    Explain the strip method for partial estimating.
17. What kind of timber is usually converted into cordwood?
    What is the approximate number of board feet in a cord of wood? Tell how cordwood may be estimated.
18. How may the content of logs be determined?
19. What is meant by the term "log rule"?
    What is the legal log rule for your state?
    What log rule is best for use with small logs?

Selected References

Books

Brown, Nelson C., A General Introduction to Forestry in the United States, John Wiley & Sons, Inc.

Kylie, Hieronymus, & Hall, CCC Forestry, United States Government Printing Office.

General Bulletins

Timber Scale Sticks—Directions for Use—The American Forestry Association, Washington, D. C.
(Given with each purchase of timber scale sticks.)

U. S. Department of Agriculture, Washington, D. C.

Farmers Bulletin 1210—Measuring and Marketing Farm Timber.

State Publications

Georgia—Leaflet 5—Estimating Standing Timber—Georgia Forest Service, State Capitol, Atlanta, Georgia.

Virginia—No. 276—Marketing Woodland Products In Virginia, Virginia Polytechnic Institute, Blacksburg, Va.

Suggested Activities

1. A timber dealer has invested $8,248.00 in labor, equipment, and standing timber. How many dollars will he have to make on the transaction to net 15 per cent on his investment? 20 per cent? 25 per cent?
2. Have each pupil find out from his parents the price received in recent months for various timber products. From this information determine the average local price being paid for various kinds and grades of lumber products.
3. Find out what is being paid locally for labor for cutting timber by the thousand board feet. By the day. By the cord. From the information obtained figure the cost of getting 48,000 board feet of timber cut and 31 cords of wood.
4. Find out what the average local cost is for hauling logs. Hauling lumber. Hauling cordwood.
5. From information obtained in Activities 3 and 4, determine the cost of cutting and hauling a distance of ten miles, 85,000 board feet of timber, and 40,000 cords of wood.
6. How many board feet of lumber are contained in 4 pieces of lumber 4 inches thick, 8 inches wide, and 16 feet long?
7. How many standard cords are contained in a stack of wood 4 feet wide, 10 feet high, and 110 feet long?
8. Make in the school or home shop a caliper for measuring the diameter of trees.
9. Build the homemade device suggested in this chapter for determining the height of trees.

10. Using the softwood volume table determine the number of board feet of lumber contained in fifteen 3-log shortleaf pines with 15 inch diameters.
11. Using the softwood and hardwood volume tables calculate the total number of board feet of lumber contained in the trees of the following dimensions:
    Nine, 3-log white oaks, 16 inches in diameter.
    Six, 4-log red oaks, 28 inches in diameter.
    Eight, 4-log slash pines, 22 inches in diameter.
12. Through the use of one or more of the instruments described in this chapter, have each pupil in the class determine the diameter and height of the trees on a small tract near the school. Tally them as suggested.
    Using the volume tables have each pupil figure out the number of board feet of lumber in the trees on the tract. Compare the results obtained by each.
13. Practice until you can secure fairly accurately the diameter and height of trees with a tree-scale stick.
14. Estimate the standing timber on all or a part of your home farm.
15. Compare the difference in contents in logs by the Doyle and International log rules. What are the contents in board feet of 6 logs, 16 feet long, and 20 inches in diameter, by the Doyle rule? By the International rule?

CHAPTER 19

MARKETING TIMBER

WHEN a farmer carries a bale of cotton to the market, all the buyers usually bid within a fraction of a cent of the same price per pound for the lint. The farmer may not even know the grade of his cotton or the price of the various grades, but he will most likely receive the current market price for his product. This is because definite cotton grades that are recognized throughout the world have been established and competition forces buyers to pay the current price for each of these various grades.

Marketing timber is not nearly so simple as selling cotton. The owner, to get full value for his timber, must know something about the quality and price of the products contained in his trees. He must know where products from different species of trees can be sold and the prices that are being paid. It is also necessary for him to know how to estimate rather accurately the value of his trees on the stump. Without this information it will be an accident if he receives a fair price for his timber.

Timber cannot be sold blindly, as is often the case with cotton, if the owner expects to secure full value for it.

Prices of Timber.—The price that an owner may expect to receive for his timber or timber products depends on a number of factors. Chief among these are (1) the demand for timber, (2) the species of trees, (3) quality of timber, (4) distance from market and

accessibility of timber, and (5) cost of labor for cutting.

If there is little demand for timber, the price that may be received will likely be low. When such is the condition timber should not be sold or cut. Usually it will pay to wait until there is a stronger demand and a better price.

Wood from certain species of trees brings a much higher price than timber products from other trees.

Courtesy Southern Region U. S. Forest Service

A Log Train and Loader

For example, black walnut sells for much more than shortleaf pine because there is not an abundance of walnut and it is much in demand because of its particular qualities.

Some stands of trees are of better quality than others. That is, they will produce a higher grade of lumber or other products than trees in another stand. Those of the best quality bring the best price.

Standing timber that is a long distance from the market or shipping point or located in an inaccessible place will not bring the top price. The extra cost of cutting and hauling must be deducted from the price.

In figuring the price of standing timber the cost of labor for cutting, hauling, and sawing must be deducted from the actual value of timber products. If labor in a section is scarce and high, it, of course, proportionately lowers the price that may be paid for timber.

Methods of Marketing.—There are several methods or ways in which woodland owners may sell timber. The one to choose depends upon a number of factors, such as the amount, kind, and quality of timber for sale, prices that may be obtained by the various marketing methods, experience of the owner, and the equipment and labor available.

The more common methods of marketing timber are as follows: (1) by lot as standing timber; (2) by log scale; (3) by count or piece; (4) by board feet of lumber.

Before selling timber a woodland owner should make every effort to find out which method or methods will give him the greatest return for the timber he has for sale.

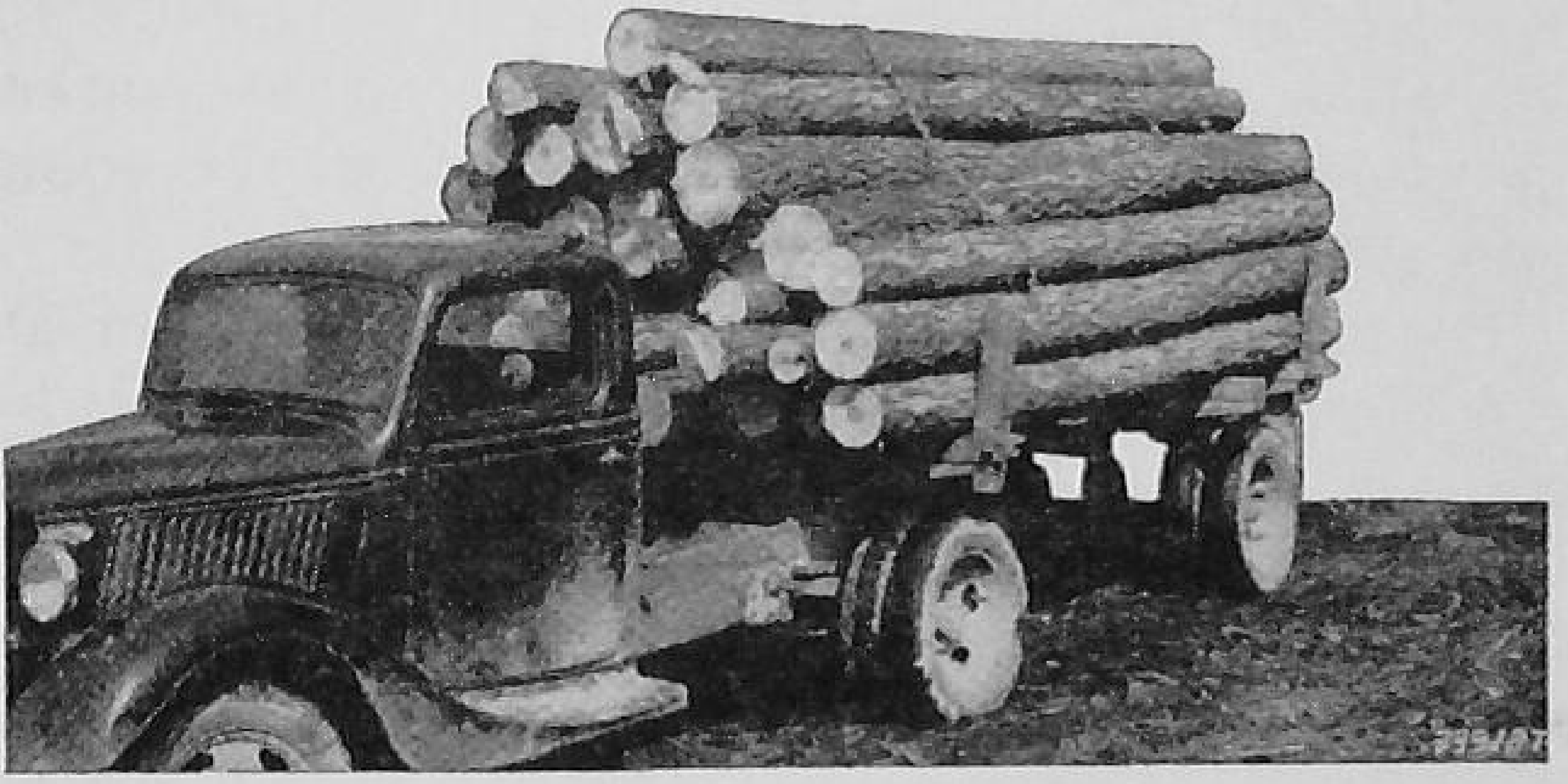
Marketing Standing Timber.—As pointed out in the previous chapter, timberland owners have lost millions of dollars through marketing standing timber. Even though this is true, the method is considered safe and satisfactory if properly safeguarded.

If timber is marketed by this method it is very important to secure a good estimate of the amount, quality, and unit value of each species in the stand. If the owner is unable to estimate standing timber it is usually profitable to employ someone who can make a correct estimate for him. It is especially desirable to have an accurate estimate if a very large body of timber is to be marketed.

After the volume of timber has been estimated the owner should then get a number of buyers to bid on the

standing timber. Competition among the buyers may help the owner to more nearly secure full value for his timber. The value of standing timber may be determined by subtracting the cost of harvesting and marketing the trees from the current market value of the products into which they may be made.

When timber is marketed on the stump it is important that a definite agreement be made with the purchaser.



UNWISE MANAGEMENT

These "logs" were too small to cut; trees of this size are making their most profitable growth

It should include such items as location of timber, size and species of trees to be cut, time limit for cutting, disposal of tops and limbs, and amount and dates of payment. It is best that such an agreement be written in the form of a contract in order to avoid misunderstandings. Suggestive forms for such contracts can usually be obtained from state foresters.

The disadvantage of this method is that it does not afford the owner the opportunity of employment for his hired hands, his teams, and himself as some of the other methods of marketing do.

Marketing by Log Scale.—In some sections and for certain species of trees, timber is sold in the log at so

Courtesy USDA

MERRY CHRISTMAS!

The most beautiful tree in the world—the Christmas tree. Each year the farmers of the United States sell millions of cedars, hollies, pines, and other species to gladden the hearts of little children and also the grown-ups

much per thousand board feet. When this is done it is necessary to use a log rule to determine the amount of timber that may be sawed from logs. Two of these log rules giving the board feet of lumber contained in logs of various dimensions and stating how to scale logs are given in the chapter, "Estimating Standing Timber."

There are two ways that logs are commonly handled in

Courtesy Southern Region U. S. Forest Service

BUCKING

Bucking is a term used among lumbermen which means cutting the tree trunk into desirable log lengths after the tree has been felled

marketing by this method. Sometimes the logs are sold in the tree and the purchaser is responsible for cutting and transportation. Often, however, the logs are cut and hauled to the mill or shipping point by the owner. The latter method is most satisfactory if the owner

desires to use his own labor and teams at off seasons of the year.

If the timber is sold in the tree to be cut by the purchaser, it is considered best to sell only marked trees that have been selected or all trees above a certain diameter limit. In some instances only certain species may be sold from a stand. After the timber is cut the logs are scaled to determine the amount of lumber in each. The log rule used is important. Some of the rules give much smaller yields than others. The Doyle Rule, which is legal in a number of Southern states, gives a low yield for logs under 28 inches in diameter. The International Rule gives log volumes that are fairer to the seller than the Doyle.

When the timber is cut by the owner it affords the owner the opportunity to grade the logs and thus more nearly market them at their true value. It also makes it possible for the owner to utilize the inferior logs of low market value on the farm. Another advantage of this practice is that owners usually exercise more care in the protection of young trees left on the ground than do those who purchase timber on the stump.

Marketing by Piece or Count.—There are a number of timber products that are sold by the piece or count. Chief among these are poles, crossties, and piling. If an owner has timber suitable for these and other similar products it is well to investigate the market for them. Selling by the piece is the most simple method of marketing timber.

Most of the poles being bought in the South today are pines treated with creosote. Such poles properly treated will last almost indefinitely. Business concerns engaged in treating poles with creosote are located at various points in the South. Most of these companies buy poles direct from timber owners. Your state forester can

Ten Helps in Marketing Woodland Products

1. Get prices for various wood products from as many saw mills and other wood using plants as possible.

2. Before selling consult neighbors who have sold timber and benefit from their experiences.

3. Investigate local timber requirements and prices. Your products may be worth more locally because transportation is saved.

4. Advertise in papers and otherwise secure outside competition.

5. Secure bids if practicable both by the lump and log-scale measure.

6. Be sure that you are selling to responsible purchasers.

7. Get a reliable estimate of the amount and value of the material before selling.

8. Market the higher grades of timber and use the cheaper for farm purposes.

9. Remember that standing timber can wait over a period of low prices without rapid deterioration.

10. Use a written agreement in selling timber, especially if cutting is done by purchaser.

U. S. Forest Service

probably furnish a list of such companies operating in your state. Be sure to get dimensions of poles that may be sold before cutting timber. Chestnut and eastern white cedar are used extensively in the South and East for pole timber.

Several different species of trees are used for piling. In the South cypress and creosoted pines are used extensively. Piling is used in the construction of bridges, docks on water fronts, and for many other purposes.

Piling may be sold to bridge contractors or to companies that creosote posts and piling.

Crossties may be sawed or hewed from any one of more than a dozen species of trees. They are used in such quantities by railroads that specifications for them were drawn up by the American Standards Association and have been adopted by all the large associations of producers and users of crossties.

Crossties for standard-gage railroads are 8, 8½, or 9 feet long; and for narrow-gage railroads 5, 5½, 6, 6½, or 7 feet long. Before cutting trees timber owners should find out the exact length and dimensions desired by the railroad to which sale is to be made.

Ties over one inch more than the standard in thickness, over 3 inches more in width, or over 2 inches more in length are usually degraded or rejected.

The standard specifications for crossties include the following regarding delivery:

"Ties delivered on the premises of a railway for inspection shall be stacked not less than 10 feet from the nearest rail of any track at suitable and convenient places; but not at public crossings, nor where they will interfere with the view of trainmen or of people approaching the railway. Ties shall be stacked in alternate layers of 2 and 7, the bottom layer shall consist of 7 ties laid crosswise of the first layer. When the ties are rectangular, the 2 outside ties of the layers of 7 and the layers of 2 shall be laid on their sides. The ties in layers of 2 shall be laid at the extreme ends of the tie in the layers of 7. No stack may be more than 12 layers high, and there shall be 5 feet between stacks to facilitate inspection. Ties which have stood on their ends on the ground will be rejected.

"Each stack shall have fastened to it a tag on which is written the owner's name and address, the date when stacked, and the number of ties of each kind of wood in the stack.

"All ties are at the owner's risk until accepted. All rejected ties shall be removed within one month after inspection.

"Ties shall be stacked as grouped below. Only the kinds of wood named in a group may be stacked together."

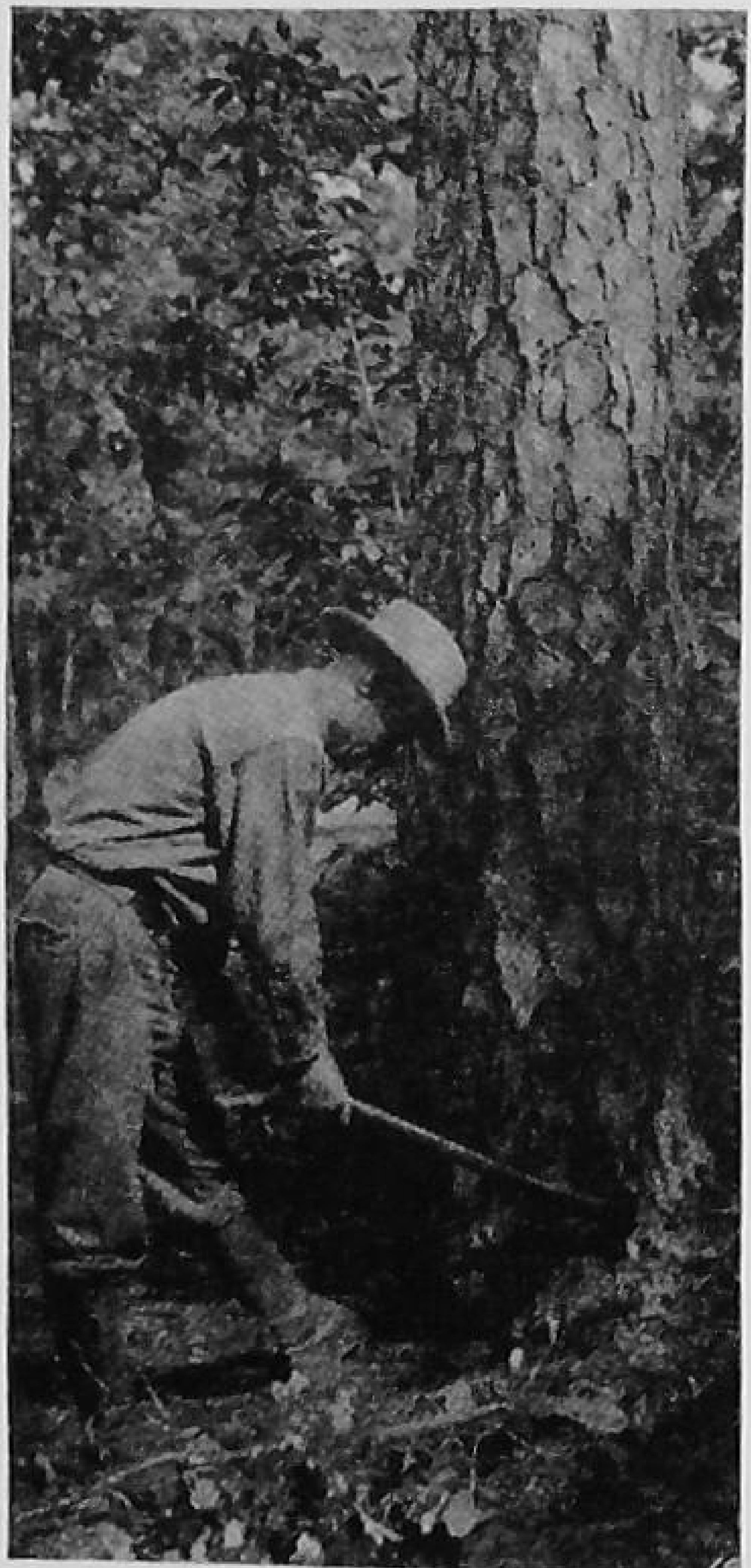
CLASS U.—TIES WHICH MAY BE USED UNTREATED

Group Ua	*Group Cc*
"Heart" black locust	"Heart" cedars
"Heart" white oaks	"Heart" cypresses
"Heart" black walnut	"Heart" redwood
Group Ub	*Group Ud*
"Heart" Douglas fir	"Heart" catalpas
"Heart" pines	"Heart" chestnut
"Heart" larches	"Heart" sassafras
	"Heart" red mulberry

CLASS T.—TIES WHICH SHOULD BE TREATED

Group Ta	*Group Tb*	*Group Tc*	*Group Td*
Ashes	"Sap" cedars	Beech	"Sap" catalpas
Hickories	"Sap" cypresses	Birches	"Sap" Chestnut
"Sap" black locust	"Sap" Douglas fir	Cherries	Elms
Honey locust	Firs (True)	Gums	Hackberries
Red oaks	Hemlocks	Hard maples	Soft maples
"Sap" white oaks	"Sap" larches		"Sap" mulberries
"Sap" black walnut	"Sap" pines		Poplars
	"Sap" redwood		"Sap" sassafras
	Spruces		Sycamores
			White walnut

Marketing by Lumber Tally.—Counting or tallying the yield from logs at the mill is a very satisfactory method of marketing timber. Especially is this true if the owner receives a fair price per unit for his products. The owner is paid a specified price per thousand for the total amount of lumber actually sawed from his timber. A tally of the lumber is made as the logs are sawed. It is important for the owner to know the quality of timber he has for sale and the current price of products into which it may be made.



Courtesy Southern Region U. S. Forest Service

MARKING A MATURE TREE FOR HARVESTING

There are several ways that timber is marketed under this method. The timber may be sold on the stump at a stated price per thousand board feet, with the understanding that the purchaser will do all the logging and hauling of logs to mill. Another way is for the logs to be cut and hauled to the mill by the owner. If this is done the timberland owner would expect to receive a higher price per thousand board feet for the timber.

Sawing and Marketing Timber.—Some farmers

with large tracts of timberland own sawmills and saw and market their own timber during off seasons for farm work. Such a method of marketing timber may or may not be profitable. It is an excellent way to provide year round employment for farm labor. The success of such a plan depends on the timberland owner's ability to market lumber successfully and the efficiency of the farm hands in operating the mill and in cutting and hauling logs. Its success is also dependent on the owner's knowledge of the kind of products to saw from the timber in order for it to bring the highest returns.

Some small woodland owners arrange to have their timber sawed on a toll basis and then market the lumber. Others pay a flat rate per thousand board feet for having timber sawed.

Marketing Cordwood.—In the South the two principal uses of cordwood are for paper making and for fuel. Selling timber for pulpwood is discussed in another chapter. A few years ago large quantities of cordwood were consumed in the South for fuel. In every little town enough stove wood was used for cooking to furnish employment for a number of people in cutting and hauling cordwood. Cotton gins, corn and flour mills, and other small industries until a few years ago used cordwood as fuel for generating steam.

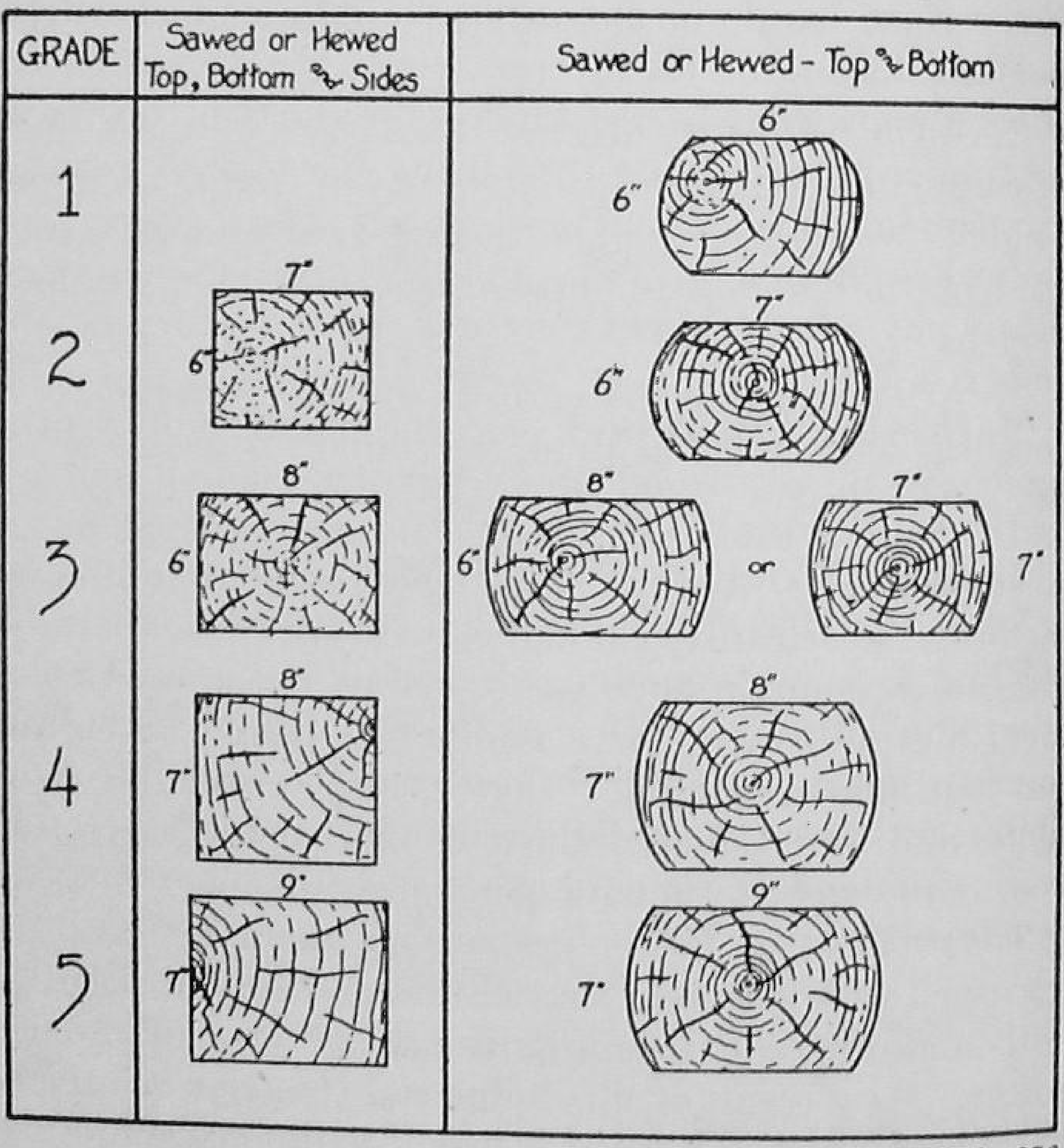
Today most of the homes in cities and villages are equipped with gas and electric stoves. Many of the gins, mills and other small industries are operated by electric power. As a result of this industrial change a relatively small amount of cordwood is used for fuel except on the farm. Consequently the opportunity for marketing it for fuel is much less than it was a few years ago.

Bolts, which are short portions of logs, are sometimes sold by the cord. Billets, which are obtained by halving, quartering, or otherwise splitting or sawing bolts or short

logs lengthwise, are also sold in some instances by the cord. In some sections of the South, bolts and billets have opposite meaning to that given here. For instance, billets are known as short logs in some places.

Ash and hickory for wheel and handle making are often sold as bolts and billets.

Before cutting timber for marketing as pulpwood it



V. P. I. Bulletin 276

CROSSTIE SIZES ACCEPTABLE

is very important to secure from the pulpmill where wood is to be sold the specifications as to the dimensions of wood. Usually mills require wood of a certain length.

Locating Markets.—A market of some kind can usually be located for the products of the more common species of trees. However, in order to secure a satisfactory price it is usually best to get in touch with a number of buyers. The following are a few steps that may be taken to find the best market:

1. Inquire of neighbors regarding the price of products recently sold and the persons or firms to whom timber was sold.

2. Write to state forester for names of individuals or companies that purchase the kind of timber or timber products you have for sale, especially if you have some kind of timber that is not commonly handled by local dealers.

3. After securing the address of such individuals or concerns write to them about the timber or products you desire to sell.

Uses of Wood.—In order for a timberland owner to more intelligently market his timber it is desirable for him to know something regarding the uses of wood from the various species of trees. Listed below are some of the more common uses of wood from the more important tree species of the South. Uses other than those mentioned here may exist, and still others may be developed:

USES OF WOOD

Loblolly Pine: Used for building materials, barrel staves, basket veneer, pulpwood, lath, piling, crossties, telephone poles when creosoted. It is not a good naval stores producer.

Longleaf Pine: Due to its strength it is used for long timbers in buildings, bridges, etc. Also used for same purposes as loblolly pine. Produces naval stores.

Slash Pine: Used for same general purposes as longleaf pine. Heavy naval stores producer.

Shortleaf Pine: Generally adapted to same uses as the other three predominant Southern pines. Not used for naval stores production.

White Oak: Has many uses such as beams, furniture, vehicles, tight cooperage, interior finish, baskets, split bottomed chairs, crossties and fence posts.

Post Oak: Used for many of same purposes as white oak. Lumber not considered as good as white oak.

Southern Red Oak: Rough furniture, general construction, crossties, interior finishing. Bark used in leather tanning industry.

Black Oak: Usually sold as red oak and used for same general purposes.

Chestnut Oak: Durable in contact with soil. Used for crossties, bridge timbers, fence posts and heavy construction. Bark preferred to all others for tannic acid.

Live Oak: Mauls, rollers, meat blocks, woodpulp, and veneer.

Black Jack Oak: Its only use at present is for fuel.

Yellow Poplar: Has a great variety of uses such as building materials, veneer, wagon bodies, furniture, imitation mahogany veneer, pulpwood, boxes, and others.

Cypress: Wood is light and soft but very durable. Its durability under exposure and in contact with soil accounts for its use for doors, blinds, piles, tanks, poles, shingles, silos, freezers, boats, greenhouse frames, etc.

Black Gum: Used for crate and basket veneers, floors, rollers, mallets, mauls, hubs, woodpulp, etc.

Tupelo Gum: Used for veneer, boxes, crates, and other similar purposes. Cigar boxes and musical instruments are made of it.

Chestnut: Has many uses such as interior finishing, doors, telephone posts, and shingles. Both wood and bark are in demand by tanneries.

Red Cedar: Used in making lead pencils, clothes chests, for lining closets and for interior finishing of rooms. Also used for telephone poles and fence posts, and for making valuable cedar oil.

White Cedar: Used for shingles, fence posts, boats, poles and cooperage.

Black Walnut: Sells for very high price. Highly valuable for furniture, desks, cabinets, interior finishing, gun stocks, sewing machines, musical instruments and aeroplane propellers.

Hickory: All hickories are used for the same general purposes such as tool handles, wagon parts, and other uses where strength and flexibility are desired.

White Ash: Used for handles, athletic goods such as tennis rackets, baseball bats and oars. Also used for furniture and interior finishing.

Cherry: Next to walnut sells for highest price of any wood in Eastern U. S. Takes beautiful finish. Used for interior finishing, cabinet making, veneer, panels, etc.

Beech: Used for flooring, tools, novelty wares, crates, bobbins, clothes pins, and for many other purposes.

Black Locust: Used for crossties, fence posts, telephone poles, and insular pins.

Sycamore: Used for butcher blocks, tobacco boxes, interior finishing, furniture, and veneer.

Red Maple: Used for furniture, flooring and wooden ware.

Persimmon: Used for shuttles and bobbins for knitting mills.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the chief factors that determine the price of timber? Explain why each affects price.
2. Name four common methods of marketing timber.
3. What are some of the safeguards to be taken in marketing standing timber? What are some of the items that should

be included in a sale contract for standing timber? Name one disadvantage of marketing timber on the stump.

4. Explain what is meant by marketing timber by log scale. What are the two ways that logs are commonly handled by this method? Why is the log rule to determine volume of logs important? What is the advantage of the owner cutting and hauling his own timber?
5. Name some of the ten suggested helps in marketing woodland products.
6. What are some of the products that are marketed by piece or count? What kind of trees are used for poles; for pulpwood; for crossties?
7. What are the lengths for crossties for standard-gage railroads? For narrow-gage railroads? What are the minimum width and thickness of crossties? What are the specifications for stacking crossties on the premises of railroads? Name some species of trees that have to be treated before used as crossties and some that may be used untreated.
8. Explain what is meant by marketing by lumber tally. Tell of the several ways that lumber is handled when marketed by this method.
9. Upon what does the success of sawing and marketing timber depend?
10. What are the two principal uses for cordwood? Why has the demand for cordwood as fuel decreased in recent years? What are bolts and billets?
11. What are some of the steps in locating markets?
12. Give some of the uses of wood for ten of the more common species of trees that grow in your community.

Selected References

Books

Kylie, Hieronymus, and Hall—CCC Forestry. U. S. Government Printing Office, Washington, D. C.

U. S. Department of Agriculture, Washington, D. C.

Farmers Bulletins—1210—Measuring and Marketing Farm Timber.

1117—Forestry and Farm Income.

Miscellaneous Publication 87—Profits From Farm Woods.

State Publications

Georgia: Bulletin 5—Uses of Georgia Woods.

Suggested Activities

1. Using the Volume Table given in the Chapter on Measuring Standing Timber figure the value of 32 pine logs 14 inches in diameter and 16 feet long at $10.00 per thousand board feet.
2. Have each pupil in class inquire in his home and from neighbors the price that is generally paid per thousand board feet for trees on the stump if cutting and hauling is done by the purchaser. Also secure the same information if cutting and hauling is done by owner. List the information secured on the board for discussion.
3. Carry pupils to near-by sawmill or to woods where trees are being cut and give a demonstration on how logs are scaled.
4. Determine the number of board feet of lumber contained in the following:

   8 pieces 2″ × 4″ — 10′ long
   12 pieces 2″ × 8″ — 12′ long
   9 pieces 1″ × 10″ — 14′ long
   6 pieces 4″ × 2″ — 12′ long

   Determine the value of the lumber at $20.00 per thousand board feet.
5. Have each pupil determine the amount of cordwood used in his home for fuel. Determine the value of the cordwood at the current market price.
6. Have each pupil list as many of the industries in the community as he can that buy timber products. Have them list

the kind of products used by each industry or manufacturing plant.

7. Have each pupil make a list of at least 20 articles made of wood, giving the name of the article and the kind of wood or woods used in making it.

CHAPTER 20

GROWING, HARVESTING AND SELLING PULP-WOOD

THE South is generally considered one of the most important potential sources of pulpwood in the nation. Over a period of many years this fact has gradually become recognized, and today it is an established truth in the pulp and paper world.

There are several reasons why the pulp and paper industry is turning southward. The time between planting and harvesting trees is much shorter than anywhere else in the United States. Pure water, needed in great quantities by the paper mills, is abundant. Chemicals, necessary in pulpwood treatment, are convenient. Clays, used in certain types and kinds of paper products, are found in southern states. Timber land, where growing timber for multiple uses, as naval stores, poles and lumber, as well as pulpwood can be combined, is comparatively very cheap. Both rail and water transportation are available.

In 1924 a survey of the pulp and paper industry showed that approximately 9,000,000 cords of wood were used annually in the making of paper products. Based upon the expansion of this industry since the survey was made, it becomes apparent that pulpwood requirements for paper and related products may be increased ten times within three decades.

At the present time more than half the pulpwood used in the United States comes from other countries. Can-

ada, Norway and Sweden provide the largest number of pulpwood tons consumed in the United States each year.

It is only in the past few years that important discoveries have been made which would indicate that the South is in a position to furnish a greater portion of the nation's pulpwood supply. Some years ago the general idea prevailed that all southern pine trees were filled with resin, the cells of the trees being packed with resin, as the gum cells of beehives are packed with honey. Experiments, however, soon proved that this idea was not correct. The cells of the trees are comparatively free from resin until the tree is wounded. Then the resin is manufactured as a salve and poured out over the wound of the tree, to protect it from insects and diseases which would attack the tree and destroy it.

The following, among other reasons, state why southern pines have been found to be excellent pulpwood and paper material:

1. Southern pines are not filled with resin.
2. The wood fibre in southern pines has been found to be longer, stronger, and lighter of weight than the fibre of wood growing in a more northern latitude.
3. Southern pines grow faster than northern trees, and pulpwood crops can be harvested more often. Surveys by state and Federal Government organizations secured the data given in the table on page 401. The table shows that at pulpwood age, 20 years, slash pine will produce ten times as much pulpwood per acre as red spruce. For that reason slash and the other native pines are recommended for planting in the South.

In addition to pines, the South has many other tree species, which have proved suitable for pulpwood, many of which are not suitable for lumber or other forest products. Some of the species which have proved

Red Spruce		Slash Pine	
Years of Age	*Number of Cords per Acre*	*Years of Age*	*Number of Cords per Acre*
30	2.2	15	9–20
40	11.7	20	15–35
50	29.1	25	20–45
60	44.2	30	25–50
70	54.2	35	28–54
80	60.0	40	31–58

valuable for pulpwood are blackgum, tupelo gum, birch, cottonwood, maple, yellow poplar, and basswood.

The South has an immense supply of pulpwood. When Joseph C. Kircher was serving as regional forester in the Atlanta office, he published a report on *The Significance of the Pulp and Paper Industry in the South.* This was based upon a study of 42,000,000 acres, which is only a fraction of the land capable of growing pulpwood in the region. Pulpwood then available on the area was as follows:

Pine	120,744,000 cords
Pulping hardwoods	66,850,000 cords

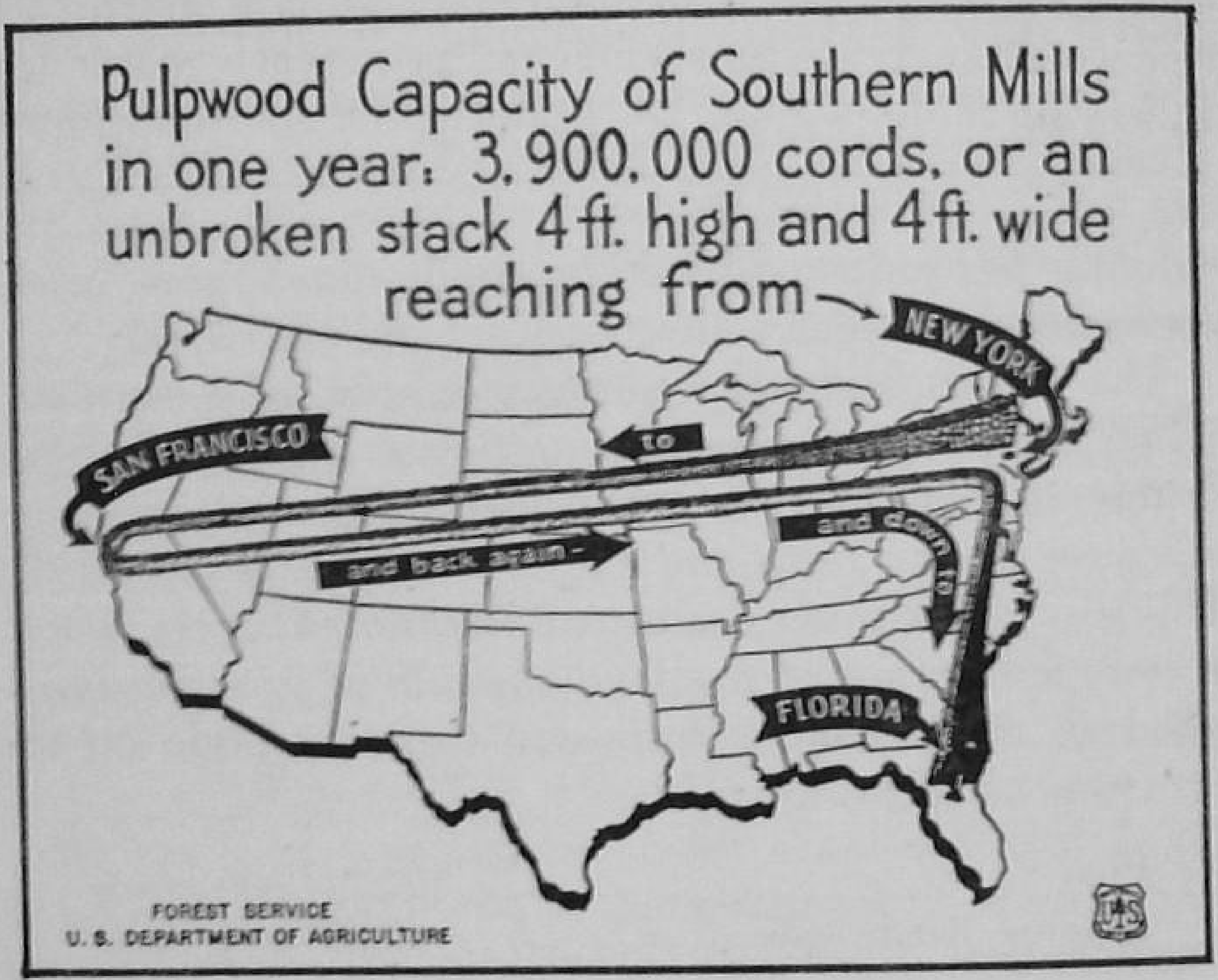
The estimated annual growth on the forty-two million acres he gave as follows:

Pine	8,083,000 cords
Pulping Hardwoods	5,968,000 cords

Some experts have estimated that throughout the entire South, the average rate of increase each year is more than 40,000,000 cords of pulpwood.

Most authorities have agreed that when trees are

planted, the landowner should have more than one product in mind. For instance, a thousand trees planted on an acre of land should yield several forest products, as pulpwood, naval stores, poles, crossties and lumber, if the most dollars are to be realized from the acre. The Southern Forest Experiment Station estimates that in combination cutting for pulpwood, lumber and other products, for stands averaging up to 10 inches in diame-



ter, 100 of the best trees left per acre will produce the most satisfactory results. They say, however, that this cutting should be done gradually and not all the trees thinned out of the stand at any one time.

Mr. Kircher also advocates that some trees be left on each acre. "Clear cutting," he said, "with or without reservation of seed trees, is bad economically, depletes growing stock, and undermines the foundations of other forest industries and independent communities."

We shall say, therefore, that when pulpwood is taken into consideration, the number of trees planted on each acre should be 1,000. When should those trees be cut? At what diameter? Let us examine the cost records supplied by the Southern Forest Experiment Station and see just how much pulpwood we could get out of each tree with a certain diameter limit, the number of trees in that diameter required for each cord, the value of each tree at 75¢ per cord stumpage and how much each tree would increase in volume and profit each year. The following table is given for loblolly and shortleaf pines:

SIZE AND VALUE

Diameter at Breast Height	*Volume per Tree*	*Number of Trees per Cord*	*Pulpwood Value per Tree at 75¢ per Cord Stumpage*	*Value of 1 Inch of Growth in Diameter*	*Increase in Value for 1 Inch Increase in Diameter*
4	0.8	106	¾¢	0.8	114
5	1.7	50	1½¢	1.2	80
6	3.1	27	2¾¢	1.9	70
7	5.2	16	4½¢	2.3	50
8	7.8	11	7 ¢	2.5	36
9	10.7	8	9 ¢	3.0	32
10	14.1	6	12 ¢	3.5	28
11	18.0	5	16 ¢	3.9	25
12	22.4	4	20 ¢	4.1	21
13	27.1	3	24 ¢	4.4	18
14	32.1	2½	28 ¢	4.7	17
15	37.4	2	33 ¢	5.1	15

This would seem to indicate that up to a certain diameter limit, the greater size a tree is allowed to attain, the more valuable it will be as pulpwood. But the time arrives when trees thickly planted, begin to struggle for existence. It is then that many of them should be thinned for pulpwood, and the remaining trees allowed to grow into products more valuable. Pulpwood should

Taking Pulpwood Out of Southern Forests

not be considered as the ultimate tree crop, but merely as an intermediate crop, the cutting of which will help the stand to maturity, the paper mill providing a market for thinnings.

Selling Pulpwood.—There are several methods of selling pulpwood. One is to sell directly to the mill itself. At first the practice of buying from the landowners was followed by the mills, but because of uncertain deliveries, of sometimes having to shut down for

days because of lack of wood, this practice was soon discontinued. The next attempt was made to contract the wood, through individual buyers. While this system works well for the mill, it is not always to the advantage of the landowner or the future wood supply, for two reasons:

1. Small tracts are cleaned of growing stock and an inadequate number of trees is allowed to remain for future needs.

2. The landowner or farmer, does not get full value from his trees or timbered lands.

The usual method under the contracting system allows so much profit to outside sources that the landowner himself receives a minimum for his wood. As a rule the pulp and paper companies let to contractors, the contractors sub-let to sub-contractors, and the sub-contractors employ men on a piece-work basis. With freight rates or the price of hauling, added to this list of profits, the farmer or landowner finds himself on the small end of the transaction.

Many times the pulp and paper companies buy timbered lands and hold them until some future date when they are faced with a shortage of pulpwood. Often they make an attempt to buy all the forested area in the territory of some rival company, sometimes as far as 250 or 300 miles from the home plant. They seldom cut pulpwood from company-owned land, however, until they are forced to such a procedure through a shortage of contracted pulpwood, or until the prices of wood are higher than they can pay. Such a policy usually tends to deplete the supply of wood much faster than it would normally be used. Mr. Kircher has estimated that the pulp and paper companies, as of 1938, owned approximately 5,000,000 acres of timbered land in the Southern states from North Carolina to Texas.

Some attempt has been made in the southern states to regulate by legislation the sale of pulpwood, but this action has not taken a very definite course. Authorities seem to feel that *education* is needed more than *legislation.* The farmer or landowner should know how much wood he has for sale, should know how it should be cut to produce the largest volume over the longest period of time, and should know how to secure adequate prices for his product.

To remedy conditions, experts say, the first step must be either the elimination of a large number of pulpwood contractors, or the establishment of an educational service for the benefit of landowners on measuring, harvesting, and selling pulpwood. Unfortunately, the methods of buying pulpwood in the south, are comparable in many cases to the old game worked on landowners since time immemorial. An estimate is made of the amount of timber on a certain tract and a flat price is offered for all pulpwood without reference to size. The amount of pulpwood may be overestimated or underestimated, but the chances are that it will not be overestimated. The buyer then proceeds to cut every available stick of timber off the land, seed trees included, and unless the cut-over area is planted the next season, years may elapse before another forest is established.

It is generally agreed that selling pulpwood by the cord is much more satisfactory than selling by acreage or by entire forest tracts. In that way, the landowner can contract to sell only such trees as come within certain diameter limits and only those trees which are least desirable in the timber stand.

If the landowner decides to sell direct to the mill, his very first step should be to get the pulpwood specifications from the pulp and paper company with which he is dealing. Each company usually has its own specifica-

tions, which means that the wood must be cut a certain length, in a certain manner, and handled in a certain way. For instance, some mills require that wood submitted to them be peeled. Others have no preference.

A company in North Carolina supplies the following pulpwood specifications:

"All wood must be sawed into five-foot lengths. No crooked sticks will be received. All limbs, branches and

Loading Pulpwood on Freight Cars from Farm Trucks

knots must be trimmed off close to the sticks. No wood of the previous year's cutting, dead wood, rotted wood, burnt wood, or wood that is ax cut in place of being sawed, will be accepted. No wood containing wire, nails, or metal of any kind, will be accepted. No round sticks shall be under 4 inches, nor over 14 inches in diameter. Sticks from 10 to 14 inches may be halved. Wood must be penned for seasoning at least 12 weeks before shipping.

"Specifications for peeled wood the same as above, with the exception that the bark and inner skin must be taken off when wood is cut. Bug peeled wood will not be accepted as peeled wood."

Several points in the above specifications require some study. It is noted that five-foot lengths are required. Cord wood is four feet long. The five-foot length wood, in a stack 4 x 8 feet, makes a cubic volume of 160 feet, where a normal cord of wood, measuring 4 x 4 x 8 feet, contains only 128 cubic feet. The five-foot cord is known in pulpwood circles as a *unit*.

The usual pulpwood specifications furnished by the buying companies give the following requirements of the wood to be purchased:

1. Size—length and diameter.
2. Condition—free from charred wood, nails, etc.
3. Limbs and knots—must be trimmed flush.
4. Wood must be taken from sound trees.
5. Ends must be sawed, not chopped.
6. Peeled or unpeeled.

However, the specifications of all mills change from one year to the next and no attempt should be made to furnish pulpwood to any mill until the *amount needed* and the *specifications of wood* are first known.

Determining Amount of Pulpwood.—Whether he plans to sell to a contractor or harvest the wood himself, the first information a landowner should have is the amount of cord or unit wood he owns. On large tracts of a thousand acres or more, or on smaller tracts as small as 40 acres, where a large amount of wood is involved, the average landowner should employ a timber cruiser or estimator. On smaller tracts or lightly stocked areas, he may make the estimate of pulpwood himself very easily.

In making the measurements of individual trees, a diameter tape or calipers may be used to take the *diameter breast high* (D. B. H.) measurement, which is 4½ feet above the ground. The merchantable height

may be estimated after the measurement of several trees for height.

If the area to be cruised is less than 20 acres, every tree should be measured. If the area involved contains between 20 and 40 acres, one fourth of the trees may be measured, between 40 and 160 acres, a 10% cruise is satisfactory, between 160 and 640 acres, a 5% cruise, and over one square mile, or 640 acres, not more than 2½% of the trees need be measured. How to determine the best method of making the various strip cruises or sample plot cruises has already been shown in the chapter, Estimating Standing Timber.

All trees between 5 and 7 inches in diameter should be included in the 6-inch class, all trees between 7 and 9 inches should be included in the 8-inch class, etc. The number of trees which fall in each diameter and height class should be tallied, and multiplied by the cubic volume of wood in each class as given in the table on page 410. After the cubic foot volume has been tallied for each class, and all classes added, the number of cords of wood in the stand may be secured by dividing the total volume by 90. By the same method the number of pulpwood units may be secured by dividing the total by 113.

For example, a fifty acre stand contains 556 trees 6 inches in diameter, with 20 feet merchantable height, 290 trees 8 inches in diameter, with 24 feet merchantable height, and 200 trees 10 inches in diameter, with 40 feet merchantable height. These figures are the result of a 10% cruise. Let us see how many units of pulpwood on the 50 acres.

First we consult the table.

One 6-inch tree, 20 feet merchantable height contains 2.7 cubic feet.

556 6-inch trees, 20 feet merchantable height contain

556 x 2.7 cubic feet, which would give us 1,501.2 cubic feet in the 6/20 class.

One 8-inch tree, 24 feet merchantable height contains 5.5 cubic feet.

290 8-inch trees, 24 feet merchantable height contain 290 x 5.5 cubic feet, which would make 1595.0 cubic feet in the 8/24 class.

The table also shows that a 10-inch tree, 40 feet merchantable height, contains 13.6 cubic feet of wood.

200 trees in this class total 2720 cubic feet of wood.

All trees measured, show a total volume of 1,501.2 plus 1,595.0 plus 2720.0, equals 5,816.2 cubic feet of wood.

Since only 10% of the total number of trees were cruised, the amount of wood given above multiplied by 10, gives a total volume of 58,162 cubic feet of wood, in the three classes.

To arrive at the number of units, 58,162 is divided by 113. The quotient 514.6, represents the number of units of pulpwood in the three classes 6/20, 8/24 and 10/40.

The following table is given for average second growth pine:

Cubic Foot Volume Table, Rough Wood

Average Second Growth Pine

DBH	Merchantable Length of Stem in Feet													
	12	16	20	24	28	32	36	40	44	48	52	56	60	64
	Cubic Volume, Including the Bark													
6	1.6	2.2	2.7	3.2	3.6	4.3	4.8	5.4						
8		3.6	4.6	5.5	6.4	7.3	8.3	9.1	10.1					
10			6.8	8.2	9.5	10.8	12.3	13.6	14.9	16.3	17.7			
12				11.2	13.0	14.9	16.7	18.6	20.5	22.3	24.2	26.0	27.9	
14					16.8	19.3	21.7	24.0	26.5	28.9	31.3	33.7	36.1	38.5
16						23.8	26.9	29.8	32.8	35.8	38.8	41.7	44.7	47.7

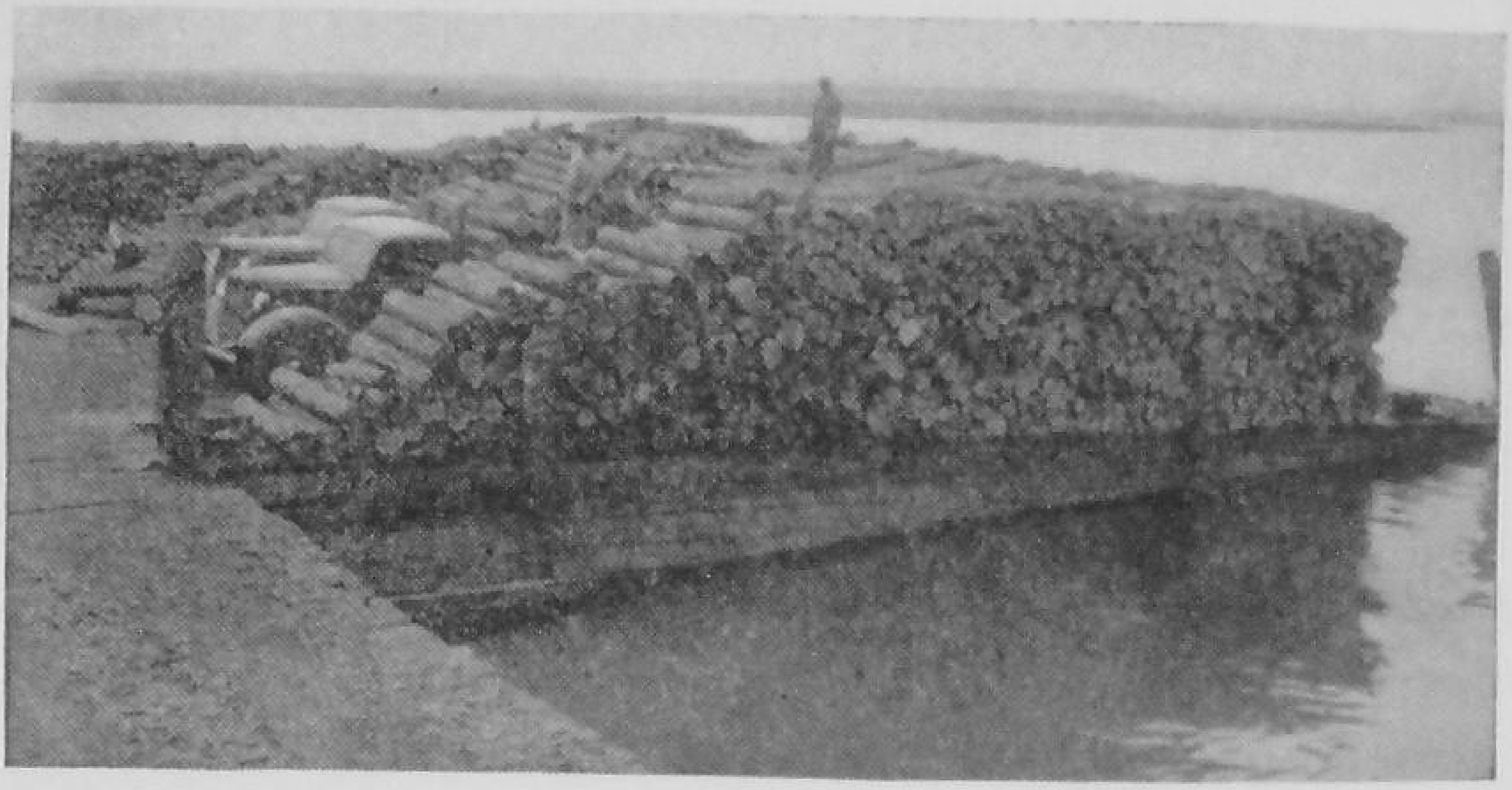
After the market has been established and the amount of available pulpwood has been estimated, the wood must be cut and harvested. Usually, in good forestry practice, this means that only the thinnings will be sold to the pulp mill, and that the quality trees will be left for poles, piling, and sawlogs. The following table has been supplied to show which trees should be cut for pulpwood and which trees should be allowed to remain in the forest:

Trees to Be Cut for Pulpwood	Trees Not to Be Cut for Pulpwood
Worked-out naval stores pines	Round longleaf or slash pines
Crooked or poorly-formed trees	The straightest, best-formed trees
The weaker-crowned trees in dense stands	Trees with good, thrifty crowns
Heavy-crowned wolf-trees, overtopping young growth	Trees needed for seed trees
Over-mature, diseased and fire-scarred trees	Trees under 9 inches in diameter, except in crowded stands

Up to certain diameter limits, the larger the trees, the less per cord are the cutting costs. This is shown in a table prepared by the Southern Forest Experiment Station at New Orleans.

Tree Diameter 4½ Feet Above Ground	Cost of Cutting per Cord
4–6 inches	$1.40
6–9 inches	.90
9–11 inches	.72
12 inches and above	.76
	Average .80

In the actual harvesting of pulpwood, a number of important rules should be followed. The trees should be cut as close to the ground as possible. This allows for greater volume. An exception to this rule is when the butt end of turpentined trees cannot be used, or when nails or other foreign matter is found in the bases



MANY PAPER MILLS ARE LOCATED ON TIDEWATER

Much of the pulpwood moves in and the finished products out by way of water transportation

of the pines. After the trees have been cut and the tops removed from above the merchantable height, the tree trunks should be cut into five foot lengths, "penned," and allowed to dry. "A pen may be made up of 4 or 5-foot wood piled in layers to form a hollow crib. Each layer consists of two sticks laid crosswise on the preceding layer after the manner of a log cabin. The 'pen' consists of sufficient layers to reach six feet in height. Five pens are supposed to make a cord unit—The pen is not an accurate basis for cordwood volume measurement and should never be used as such."

These pens are important. Wood left on the ground will absorb water and be unfit for pulp.

If the wood is to be peeled, a sharpened spade makes a good peeling spud. So does a sharpened planting dibble. Sometimes a drawknife is used. All limbs should be cut flush with the trunk, to make peeling easier.

Care should be taken never to ship more wood than the plant orders. When wood is allowed to remain unused over long periods, a sap stain appears and the wood deteriorates, making it less fit for pulp.

The South must conserve its timber supply to meet the growing demand for pulpwood. The pulp industry is rapidly moving to southern forest areas. The Regional Forester of the United States Forest Service says, "The expansion of the pulp and paper industry in the South—carries with it an investment of about $70,000,000 in plants and equipment. This is in addition to approximately $81,000,000 already invested in pulp and paper mills in the South."

For the success of the program of pulp expansion much will depend upon the attitude of the landowners and timber growers of the southern states.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Have we been growing all the pulpwood used in the United States?
2. Where does our pulpwood come from?
3. What were the first objections given for not using southern pine?
4. Are any trees used for pulpwood other than pine?
5. What are some of the advantages the South has as a source of pulpwood?
6. How much pulpwood is used annually in the United States? Can we grow that amount? How much can be grown annually in the South?

7. How do paper mills secure their pulpwood?
8. Which is the best method from the viewpoint of the land-owner?
9. What is a *unit* of pulpwood? Is this the same amount of wood as in a cord?
10. Why do the paper mills buy forest land? Do they get pulpwood from their own land?
11. What is the price of pulpwood per unit?
12. How large should trees be when cut for pulpwood?
13. How may the pulpwood on a tract of land be determined?
14. What is meant by *specifications* for pulpwood? What are some of these specifications?
15. Give a plan for making the most money from a forest tract which will include selling wood for pulp.
16. How may pulpwood be a source of income in relation to forest thinning?
17. What trees should be cut for pulpwood? What trees should not be cut for pulpwood?
18. What is the relation of the size of the trees to the cost of cutting?

Selected References

U. S. Forest Service, Southern Forest Experiment Station.

Occasional Paper No. 57—Pulpwood Yields From Experimental Thinnings in Old Field Stands of Loblolly and Shortleaf Pines.

Occasional Paper No. 58—An Investigation in Pulpwood Production From Round and Turpentined Longleaf Pine.

Occasional Paper No. 71—Pulpwood Production Studies in Shortleaf and Loblolly Pine Stands.

Pulpwood and the Farmers of the South.

Report on Significance of Pulp and Paper Industry Expansion in the South.

State Publications, State Forest Services

Georgia—Leaflet No. 8—The South a Source of Wood Pulp.
North Carolina—The Pulpwood Market in North Carolina.
Virginia—Bulletin No. 276 (VPI) Marketing Woodland Products in Virginia.

Suggested Activities

1. From your state forest service or state extension forester ascertain how much wood was sold for pulp last year in your State.
2. From the same sources as above, or from the paper mills, find out what the specifications for pulpwood are in the mills buying in your State.
3. From landowners who have sold pulpwood find out what they think of this market outlet for wood, what they get for wood per unit, and what management policy of cutting they follow.
4. Following the plan outlined in the text, determine the units of pulpwood on a given forest tract.
5. Outline a plan of forest management adapted to your community which will include the production and cutting of pulpwood.

UNIT VII—REFORESTATION

CHAPTER 21

REFORESTATION

MANY persons have the idea that reforestation embraces all phases of forestry. Others think the word means forest conservation. It is, perhaps, the most misused term in forestry.

Reforestation is but one phase of forestry. In its more limited sense, it means the growing or propagation of trees. It means the restocking of forests. It includes both *natural* and *artificial* planting.

Natural reforestation is Nature's own way of re-establishing a forest. Through this method, the seeds from "mother" trees fall to the earth and produce seedlings.

Artificial planting deals with the work of man. It means the planting of forest trees, as a farmer plants a crop of cotton or sweet potatoes. It embraces such tasks as the collection of seed; the growing of seedlings in nurseries; digging up the seedlings produced by Nature; the planting of the little trees; and such care as they may require in getting established.

Both methods are used in good forest management. One often supplements the other.

Natural Reforestation.—Nature's method of reforestation is less expensive than the planting of trees by hand. But the results are not always so satisfactory. Yet, it should be employed when and wherever possible. When a stand of timber is cut, a few *seed-trees,* well

distributed, should be left standing. From such trees, ultimately, a new growth will develop.

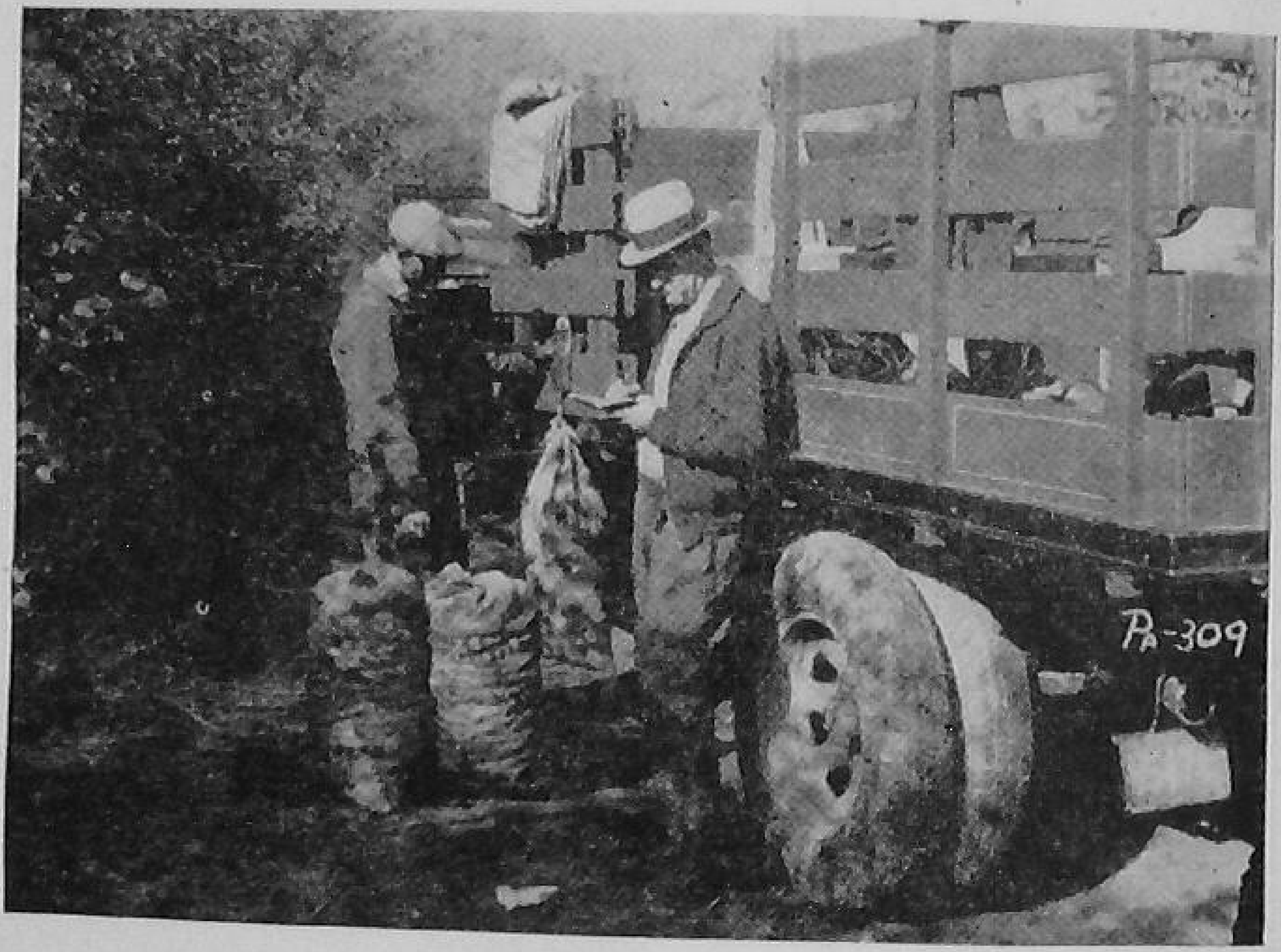
Seeds are not distributed evenly by natural means. Close to the mother tree, small trees, known as seedlings, will grow in a dense stand. Several hundred feet away, the stand of young trees will be sparse indeed, so the forester must thin near the seed-tree, and plant the gaps where the seeds have fallen in small numbers or where no seedlings have sprouted.

A Seed Tree

Many Seeds Destroyed or Lost.—In natural seeding, many good seeds are lost. Nearly all seeds are food for birds, mammals, or insects. Only one seed from among many escapes to grow into a seedling and eventually into a tree. By collecting seeds and planting them in seedbeds, then transplanting the seedlings, the percentage of survivals is increased from less than one per cent to about eighty per cent.

Experiments conducted on the Southern Forest Experiment Station land near Saucier, Mississippi, revealed that only a few seeds produced from the longleaf pine tree grew into seedlings. In this study, a section of ground was cleared under one longleaf tree, and another section nearby allowed to remain in a dense growth of wire grass. Most of the seeds which fell into the grass

were held above the soil by the dense growth and soon lost their viability, or power to germinate. The seeds which fell on the cleared plot were quickly eaten by birds and small mammals. Only a few seedlings appeared during the years the study was in progress.



COLLECTING TREE SEEDS

The Soil Conservation Service is one of several government agencies that collects and buys tree seeds for forest nurseries

Of the millions of baby pines that do appear from natural seeding throughout the South, a large percentage are destroyed by hogs, or lost through other destructive forces.

The initial cost of planting trees is, of course, more expensive than allowing a forest to restock itself by natural means. Often, however, the artificial method is the only practical way of getting a good even stand of trees started on a piece of land. This is true of a

field which has been in cultivation and does not have desirable species of trees located near it. In the South

Courtesy Southern Region U. S. Forest Service

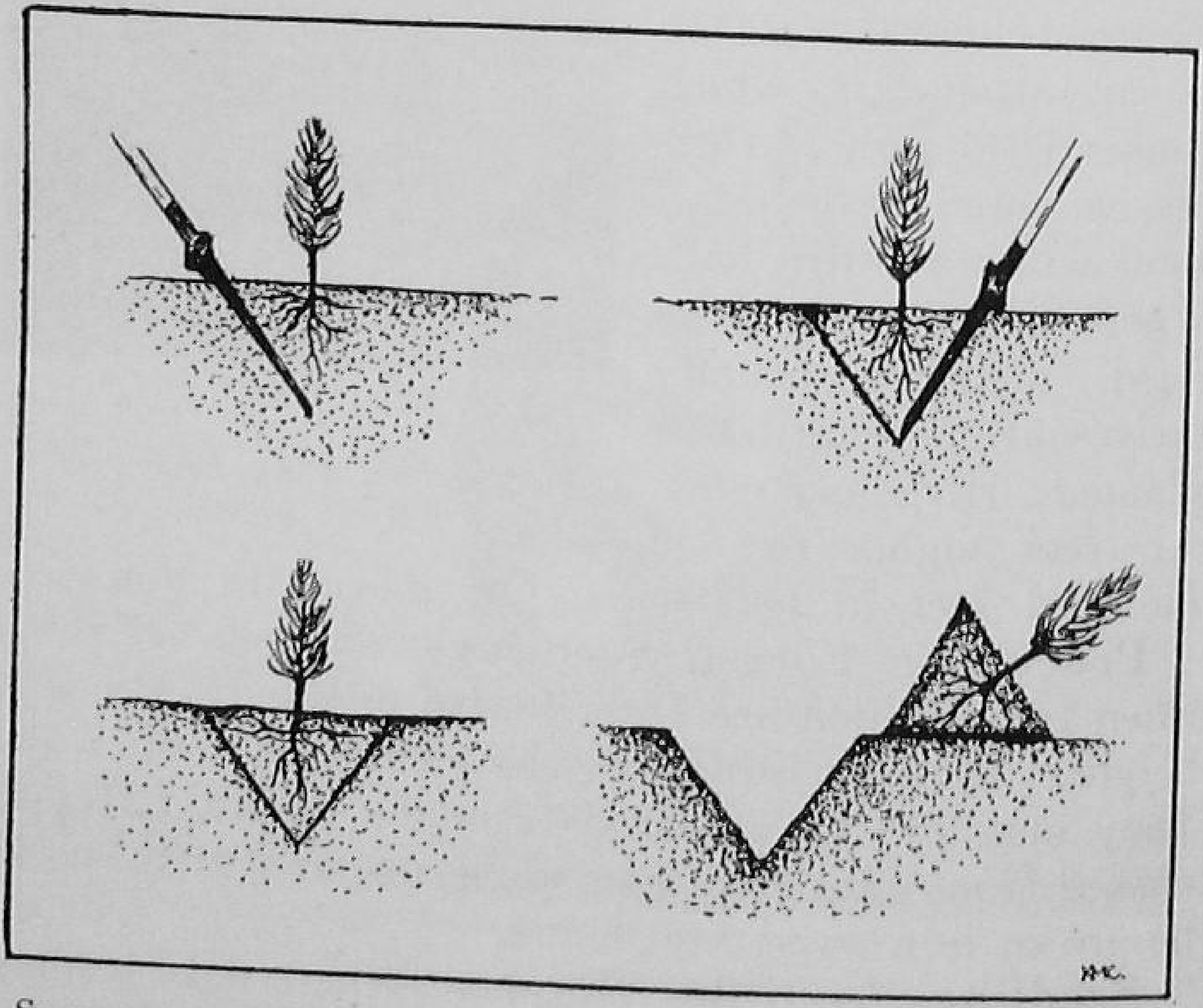
NATURE'S REFORESTATION

Note the young trees ready to replace the mature tree that will soon be harvested

there are millions of acres of eroded and submarginal land which should be planted to trees. Such lands must necessarily be planted. If left to become stocked with trees by natural means, such land will be gullied and depleted of soil fertility before a ground cover of trees has been established. Many times undesirable species appear on land which has been abandoned.

Planting Trees.—Many millions of trees are now planted each year in the South. Years ago only trees to be used for ornamental plantings were transplanted. In recent years, however, since the present interest in forestry and conservation developed, thousands of acres of land are planted annually to forest trees.

The methods used in planting ornamental and forest trees are quite different.



Showing the Proper Way of Removing a Natural Seedling for Transplanting

Ornamental trees, whether secured from a commercial nursery or dug up in the woods, are usually larger than those planted for forest purposes. Then too, ornamental trees are handled in a different manner. Usually the tree planted to beautify a landscape is dug with a ball of earth, which is large enough to contain most of the tree's root system. This earth ball is wrapped in some material such as burlap and the root system is undisturbed. Often the larger trees are root-pruned. Several months before the tree is moved, a trench is cut around it, which causes it to grow an excessive number of small roots within the dirt ball. When this method is practiced, the tree usually thrives after being transplanted. Large ornamental trees eighty or one hundred feet in height may be moved in this way.

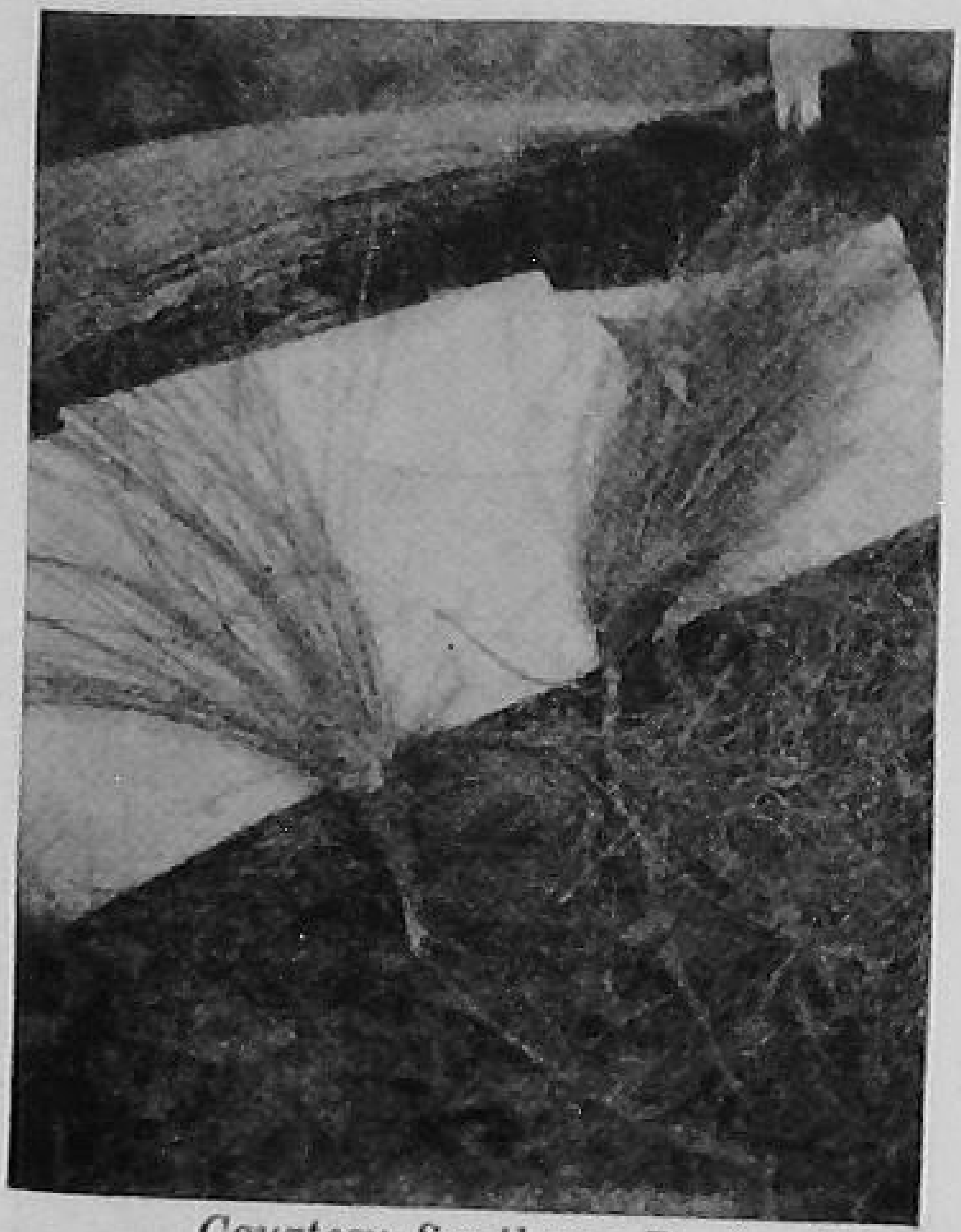
Courtesy Southern Region U. S. Forest Service

PLANTING PINE SEEDLINGS

Procuring Forest Seedlings.—Forest seedlings when transplanted are from twelve to twenty inches in height. These seedlings may be secured in many ways. They may (1) be gathered from the woods, (2) purchased from state or private nurseries, or they may (3) be grown in a nursery at home.

Seedlings from the Woods.—Where only a small number of seedlings are needed, and when desirable species are available, they may be gathered directly

from the forest. The procedure of collecting such seedlings is simple. They are to be found near the seed-trees. Many seedlings may be secured in a short time. For example, two energetic boys collected 10,000 cypress seedlings from a swamp in one day. In one day 6,000 cedar trees were secured.



Courtesy Southern Region U. S. Forest Service

SEEDLINGS "ROOTED UP" BY HOGS

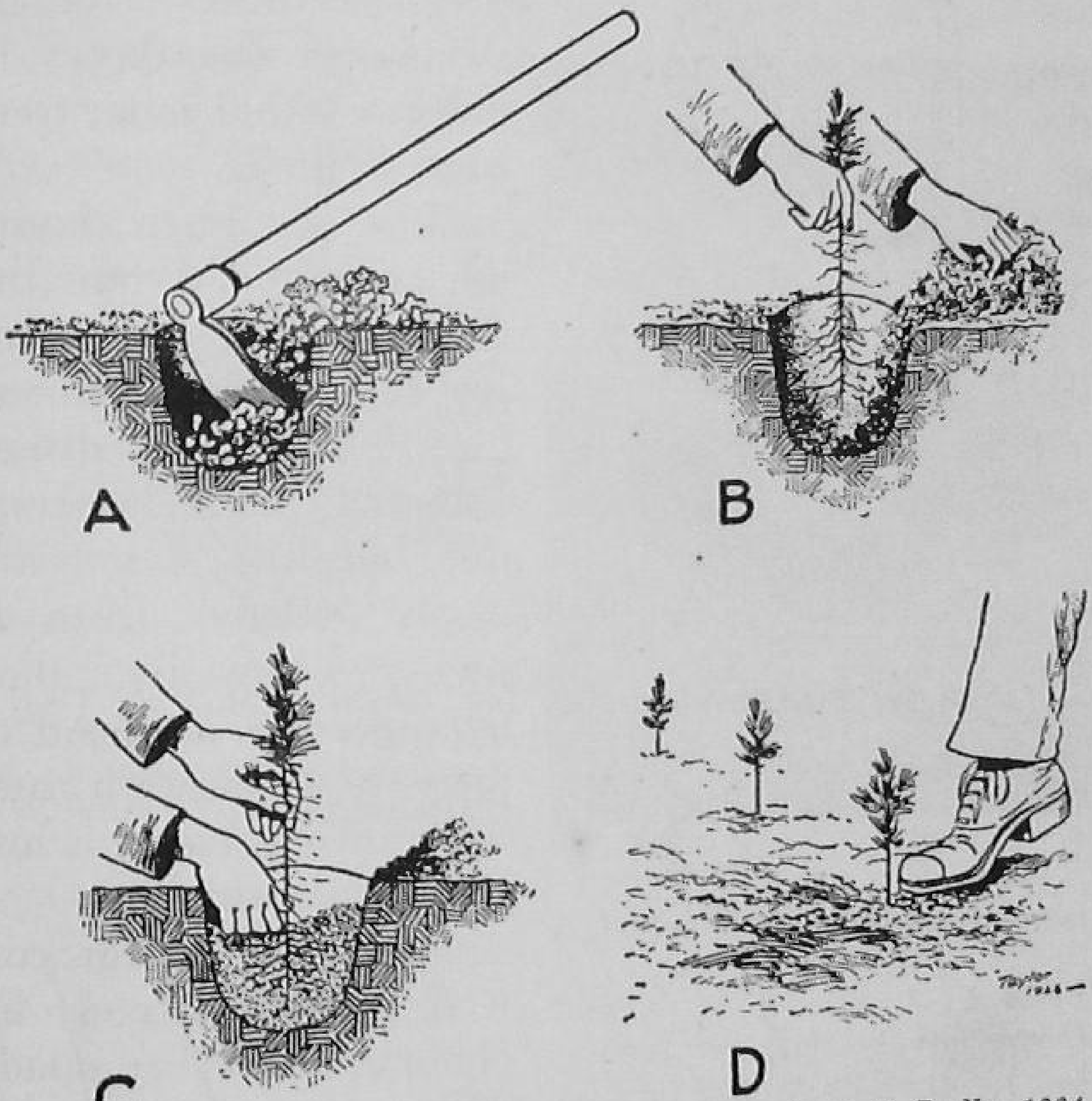
Fortunately, the "piney woods" hog is disappearing, for farmers have learned that they destroy young trees and that hogs are more profitable when feed crops are provided for them. Goats also destroy young trees

Wild seedlings should be collected from the woods in late winter, or just before the spring growth begins. Seedlings gathered in the spring, after growth starts, are easily killed. Even if such seedlings live, they must become adjusted to their new location and one growing season is lost in transplanting.

Tools needed for collecting young trees include a shovel or spade and a large bucket. A mattock may be used instead of a spade, and, in sand or soft earth, only a trowel is necessary for removing the young seedlings.

The root systems of most seedlings cover approximately the same space under the ground as the top or crown covers above the surface. The spade, or other tool, must be pushed into the earth far enough away from the base of the tree not to injure the root system. The little tree, with the earth which covers the roots, is

removed. The earth is then crumpled off gently with the fingers in such a manner as not to disturb the tiny root hairs. The small plant is then placed in the bucket, which has been filled with water.

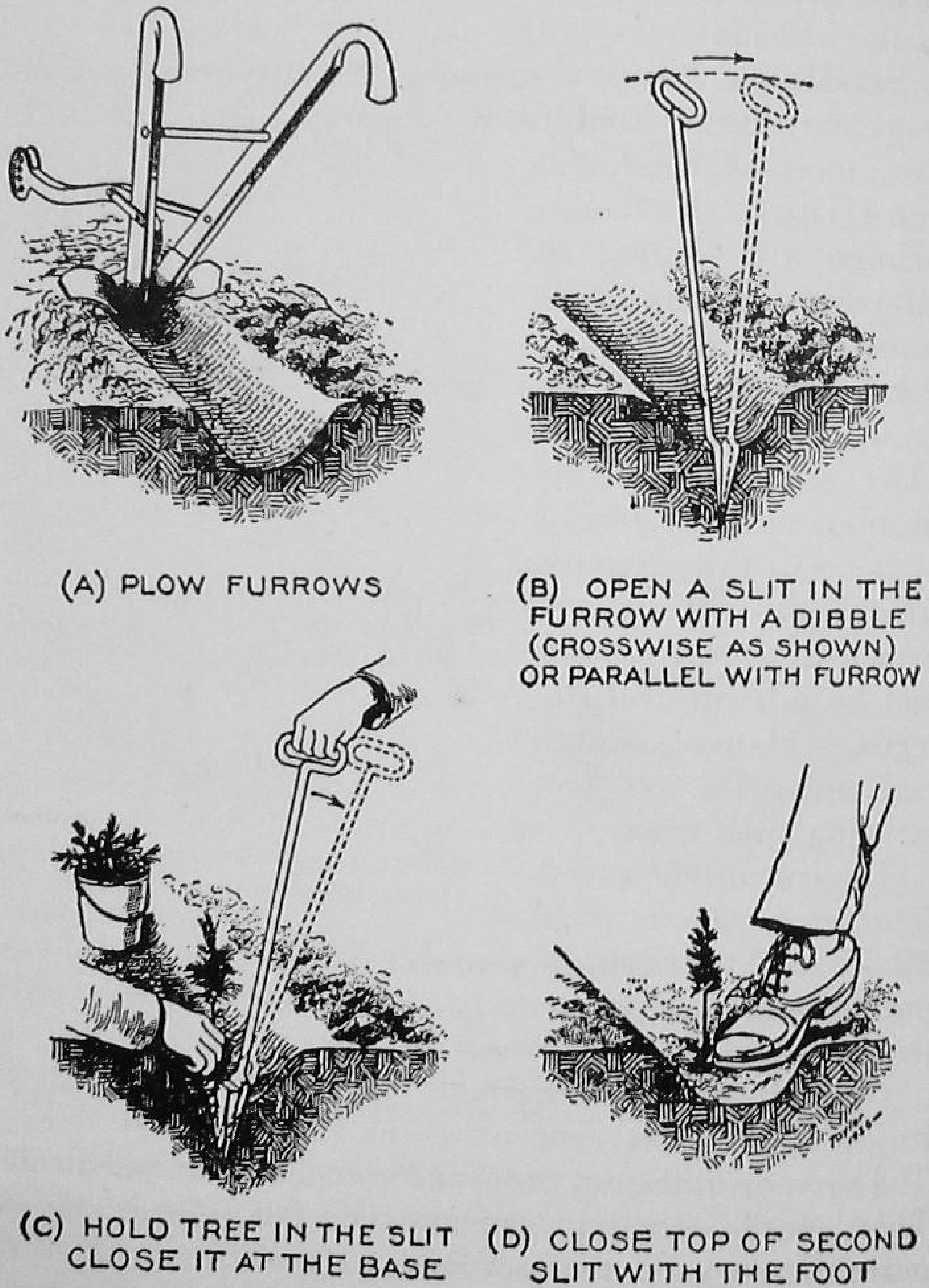


PLANTING WITH THE MATTOCK

A. Dig hole large enough to spread the roots
B. Partly fill the hole and pack the soil
C. Pack the soil twice before filling the hole
D. Firm the soil and scrape loose soil or litter over the surface

The root hairs, or tiny feed roots, are very delicate. Whether the seedlings are removed from the woods or from the nursery, the root hairs must not be exposed to the air. They will die very quickly, perhaps in the time that a boy might hold his breath.

If the seedlings cannot be planted within twenty-four hours after being taken out of the ground, they should be "heeled in"; that is, they should be placed gently

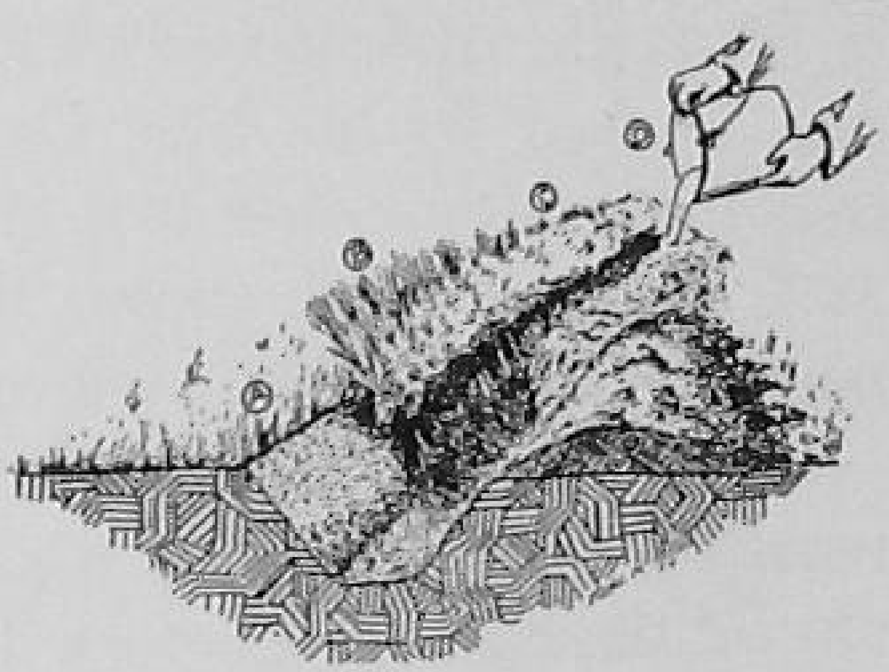


From F. B. No. 1256

THE STEPS IN PLANTING WITH THE DIBBLE

into a small trench and covered with moist earth. They should not be left too long in water. When "heeled in" properly they may be kept for a long period of time. Heeling is essentially a method of planting, in so far as the life-functions of the plant are concerned.

Seedlings from Commercial Nurseries.—Seedlings may be secured from commercial nurseries. In fact, most of the forest seedlings that are planted are secured in this way. Every state forest service in the South is engaged in the growing of seedlings. They are produced by millions in the nurseries of the Soil Conservation Service. They are grown by forest schools and by agricultural colleges. Many commercial nurseries are now growing such trees.



THE PROPER METHOD OF "HEELING IN" TREES

A. Dig a deep V-shaped ditch
B. Place a thin layer of trees against the sloping side
C. Cover roots with moist soil and pack firmly
D. Keep soil moist
E. Roots are exposed in the drawing merely to illustrate the method. They should be covered at all times with moist soil

The cost of such seedlings varies from about $2.50 to $3.50 per thousand. When produced by a public service organization, the landowner pays only the actual cost of producing the trees.

Of course, any landowner may grow his own seedlings. This plan may prove to be very satisfactory. The greatest difficulty involved is watering the seedbeds. They must be watered during the critical periods of germination and early growth.

Selecting a Planting Site.—Selecting a site on which seedlings are to be planted is the first step in re-

forestation. The site, in most instances, will determine the number of trees required.

Almost any type of land will grow pines. They are found on high, rocky hillsides, and in bottom lands.

Slash, longleaf, and loblolly pines are the species planted most extensively. They constitute the largest part of the seedlings produced in nurseries.

Black locust is now being grown extensively. This tree is used by the Soil Conservation Service in controlling erosion. The tree is planted in gullies and in other badly eroded areas. It is valuable for the purpose of controlling erosion and is used for fence posts.

The kind of trees to grow is a second decision that must be made, after the site is selected. The decision should depend upon the use to which the trees are to be put and the adaptability of the species which may be most desired to the soil and climate.

Puddling.—One important feature of the planting job is known as puddling. Before the trees are planted they should be placed in a bucket of liquid mud, which is made by working clay and water into a soup-like mixture. By submerging the root system of the seedling into this solution and allowing the tiny root hairs to become coated with the mud, the planter is multiplying the chances that the tiny plant will survive. The wet mud protects the roots until they are able to secure moisture from the soil.

Spacing.—On more-or-less level land, trees are planted in straight rows. On land that is hilly, where erosion is a serious problem, trees are planted with the contour of the land. This means that the rows "run around" the hill at about the same level.

The distance between the rows, and the distance between the seedlings in the row, is known as spacing. The

number of trees required for planting any area is determined by the spacing.

The (1) number of trees required per acre at the different rates of planting; (2) the spacing recommended for hardwoods; and (3) the suggested spacing for pines in the South are given in the following tables:

TREES REQUIRED PER ACRE FOR DIFFERENT SPACING

Spacing	*Number of Trees*
6×6 (feet)	1156
7×7	880
9×9	681
9×9	538
10×10	436
11×11	360
12×12	302
13×13	257
14×14	222
15×15	193

RECOMMENDED SPACING FOR HARDWOODS

Species	*Spacing*
White Ash	6×6
Black Cherry	6×6
Cottonwood	10×10
American Elm	6×8
Hickories	6×6
Black Locust	6×6
Oak	6×6
Sycamore	8×8
Black Walnut	6×8
Yellow Poplar	10×10

Suggested Spacing for Planting Southern Pines

Species	*Intended Use*	*Suggested Spacing*
	Timber production without thinnings	6×8 7×7 8×8
Longleaf and Slash	Combined timber and pulpwood production	6×6 6×8
	Naval stores production	10×10 12×12
	Timber production without possibilities of early thinning	6×6 7×7
Loblolly and Shortleaf	Timber and pulpwood	5×5 6×6
	Erosion control	3×3 4×4

It will be noted from these tables that the use determines, more than anything else, the proper spacing. It will be noted too, in the case of the hardwoods, that the size of the tree is taken into consideration in the spacing recommended.

How to Plant.—After the seedlings have been acquired, the tools collected, the site selected, and the rate of planting, or spacing determined then comes the actual planting of the little trees. Usually two men are required for this work. Besides the bucket of soupy mud in which the roots of the young trees are placed, they must have some tool to penetrate the soil. This tool may be a mattock, a spade, or a special planting tool called a *dibble*. Dibbles may be made in the farm shop by flattening the end of an iron rod into a blade, or by placing an iron blade on the end of a wooden handle.

Some persons burn off the land before planting but that is an unwise practice. It exposes the young trees to the sun, wind, and the attacks of various predatory rodents.

The two men used in planting are the *dibbleman* and the *planter*. The first makes the holes, the second places the seedlings. Two experienced men can set out eight or nine hundred trees in a day.

A Forest Nursery

Established by vocational boys in the Tate Agricultural High School, Gonzalez, Florida

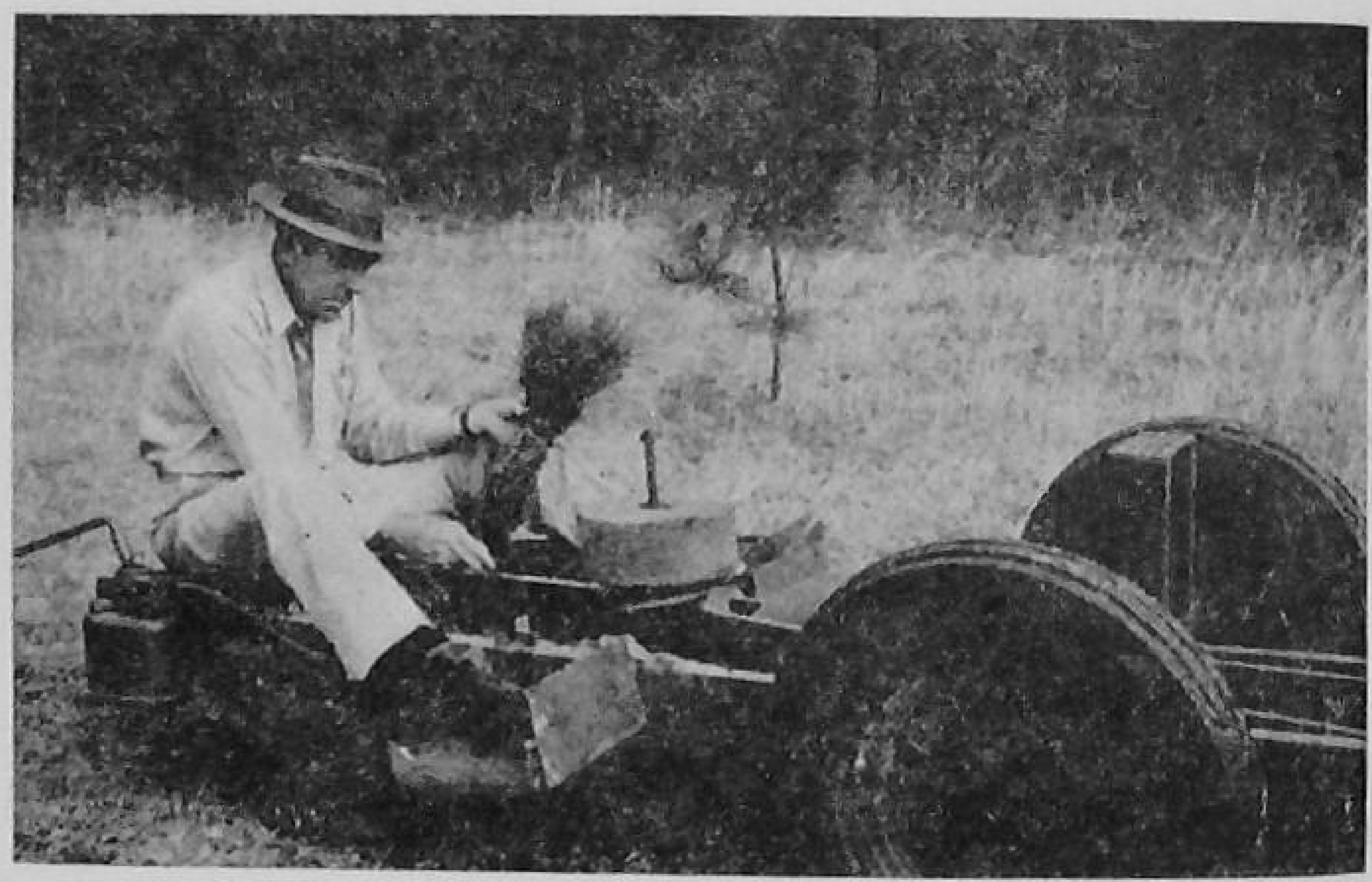
The experienced dibbleman knows just how many steps he should take in spacing the trees. At the desired location he pushes his dibble into the ground, pushes it forward and pulls it back, making a V-shaped opening. The dibble is then removed. The planter pulls a seedling from his bucket of mud, pushes it into the V-shaped hole made by the dibble, and shakes the roots out straight. The dibbleman completes the planting by pushing the soil around the young tree.

Recently a mechanical tree-planter has been developed which reduces labor in reforestation. This is a two-man machine. One of the men operates the tractor, which pulls the planter; the other man sets the trees in the trench that is formed. Then, slanted wheels press soil around the seedling, as is done by the dibble in hand planting.

If the seedling to be planted is longleaf pine, the

center bud is left about one inch above the surface. If the bud of this species is covered with earth, it will die.

Good Care Insures Faster Growth.—The more attention and care planted trees are given, the faster they will grow. This was demonstrated with a field of slash pine trees that were planted a few years ago in South Georgia. The trees were planted in a cultivated



MECHANICAL TREE-PLANTER

This modern, two-man machine reduces the labor involved in reforesting large tracts of land

field. For three consecutive years corn was planted and cultivated between the rows of pines. The fourth year found the trees over five inches in diameter and more than one hundred inches in height. This unusual growth was the direct result of controlling weeds and other plants that normally would have competed with the trees, and to the plant food applied to the corn crop.

Replanting.—Many times, when a good stand of trees is not secured the first year, the landowner or for-

ester finds it necessary to replant the second year. There is very little difference in the size and height of trees planted one year apart. All "skips or gaps" should be located at the end of the first year and the additional trees required to make a perfect stand should be planted. For any crop, a perfect stand is required to produce a satisfactory and profitable yield and income.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by the word reforestation?
2. What are the two ways of re-stocking a forest?
3. Which of the two is the more satisfactory? Discuss.
4. What is meant by a *seed-tree?*
5. What are the advantages of natural reforestation? The disadvantages?
6. Why are so many seeds lost in natural reforestation; that is, why do so few produce trees?
7. What are the advantages of planting trees?
8. Tell how ornamental trees of large size are transplanted.
9. What are some of the differences in transplanting ornamental and forest trees?
10. From what sources may forest tree seedlings be secured? Give the advantages and disadvantages of each source.
11. If seedlings are secured from the woods, at what season should they be dug? Why?
12. Tell how to remove a seedling from the woods for transplanting.
13. What is meant by the term *root hairs?* What is their function? How may they be protected?
14. How many seedlings could two boys collect in the woods in one day? How many acres would this number plant?
15. What tools are required for collecting seedlings from the woods? What tools are needed for planting?

16. Why should the trees be put in water? Should they be allowed to stand in water for a long period of time?
17. If trees cannot be planted soon after getting them from the woods, what should be done with them?
18. How much do seedlings cost when purchased?
19. Discuss selecting a site for planting trees.
20. What is meant by the term *puddling?* Explain.
21. What is meant by *spacing?*
22. Explain what is meant by *contour planting.* What are the advantages? Where used?
23. How many trees are required per acre when spaced 6×6? 10×10? 15×15?
24. What spacing is recommended for Black Locust? For Black Walnut? For Yellow Poplar?
25. What spacing should be used for Slash pine planted for timber and pulpwood? For naval stores?
26. What spacing is recommended for erosion control? Why different from other recommendations?
27. Tell how to plant trees.
28. How many can two men plant in one day?
29. What is a *dibble?* How used?
30. What recommendations are made about replanting?

Selected References

U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletins

1123—Growing and Planting Hardwood Seedlings on the Farm.
1453—Growing and Planting Coniferous Trees on the Farm.
1628—Growing Black Locust Trees.

Leaflets

32—Artificial Reforestation in the Southern Pine Region

State Publications

Arkansas—Bulletin 6—Forest Planting in Arkansas
Georgia—Bulletin 16—Planting Longleaf and Slash Pine
Florida—Circular 2—Planted Pines Pay
Maryland—Forest Planting in Maryland
Oklahoma—Publication 6—Planting and Care of Forest Trees
South Carolina—Forest Planting in South Carolina
Virginia—Publication 46—Trees for Reforestation in Virginia

Suggested Activities

1. Visit a forest or wooded area to observe Nature's method of reforestation. Note how the seedlings are grouped around the seed tree; how far they extend in all directions from the "Mother" tree; and the spacing. Write a short report of your observations.
2. Visit an area reforested by man. Make the following observations: (1) species of trees; (2) spacing; (3) per cent of stand; (4) the age of the trees; (5) the height; and (6) the advantages as compared with Nature's method. Record these observations in your notebook.
3. Using the 6 × 6 spacing recommended for black locust, how many trees will be required to plant ten acres?
4. When slash pine is planted for naval stores production how many trees will be required to plant 235 acres?
5. If two experienced men set out 800 trees a day, and receive one dollar a day each, and the trees cost $3.00 per thousand, how much will it cost to plant an acre of Slash pine set 10 × 10 feet apart?
6. Using the same rate for labor and the same cost for trees as given in the problem above, what would be the difference in cost per acre of planting trees 6 × 6 and 15 × 15?
7. In your school or home shop, make a dibble for use in planting trees.

8. Conduct this experiment: Pull up a number of pine seedlings by grasping them just at the surface of the soil. Dig the same number in the manner described in the text. Plant both lots of trees in separate rows and determine the per cent of each which live.
9. Conduct this experiment: "Heel in" a number of seedlings as shown in the illustration in the text. Keep a like number in water for this same length of time, say three days. Plant the trees in separate rows and determine the per cent of each that live.
10. Suppose a young man, or perhaps two working together, wished to make some money. If they could get a job planting pine seedlings, which they furnished by digging them up in woods, how much should they charge per acre?
11. Plant a school forest. Even though only a small amount of land can be secured, plant an area to the species of trees most desirable in your community. Arrange to have the rate of growth recorded at the school from year to year.
12. Make a study of reforestation in your community. Find out (1) how many landowners have planted trees; (2) how many acres each has planted; (3) what kind of trees were planted; (4) where the seedlings were procured; (5) how they were planted; (6) how they were spaced; (7) what per cent lived; and (8) how rapidly they have grown.

CHAPTER 22

FOREST NURSERIES

SEVERAL distinct steps, or jobs, may be listed in the operation of a forest nursery.

First, the seed must be secured. *Second*, the ground must be prepared, planted and tended until the young trees are ready to be removed from the seedbed. *Third*, the seedlings must be removed from the beds and either packed for shipment or transplanted in some nearby field.

Collecting Seeds.—Seed for the nursery may be secured in several ways. There are a number of business firms that handle nothing but tree seed. Anyone who wishes to plant a nursery may secure seed, in either large or small quantities, from one of these seed concerns at a reasonable price.

Perhaps the best way for most individuals who want to plant a tree nursery is to gather the seed from producing trees. This method of securing seed is less expensive and in some instances has become a profitable business for boys who have the time to devote to it.

Seeds may be collected throughout the entire year. Some seeds which are persistent on the trees, as black locust, dogwood and holly, may be gathered during the winter months. Some tree seeds mature in early spring. The American elm and the red and silver maples are examples of the trees which bear their seeds in the springtime. Those seeds must be collected before they are blown away and lost. The seeds of many trees

ripen during the summer months. Among those tree species that bear fruit during hot weather are the red mulberry, wild cherry, plum, and service berry. Most tree seeds ripen in the fall of the year. Perhaps that is because Old Dame Nature is busy trying to put a layer of fat on all her creatures and at that time of the

Courtesy Southern Region U. S. Forest Service

THE U. S. FOREST SERVICE MAINTAINS MANY NURSERIES

year she is more bountiful with her fruits and nuts. Acorns, chestnuts, hickory nuts, persimmons, pine seed, and many other kinds of seeds are among her bounteous supply. It is interesting to note that most of those fruits occurring in the summer months are acid fruits, while those which appear in the fall are either sugary or oily.

Almost every type of seed is collected in a different manner. Seeds like acorns and hickory nuts which are pinched from their snug cradles on the tree by cold

frost-bitten air and dropped to the ground are easily collected. They are merely picked up off the ground and stored until the season for planting.

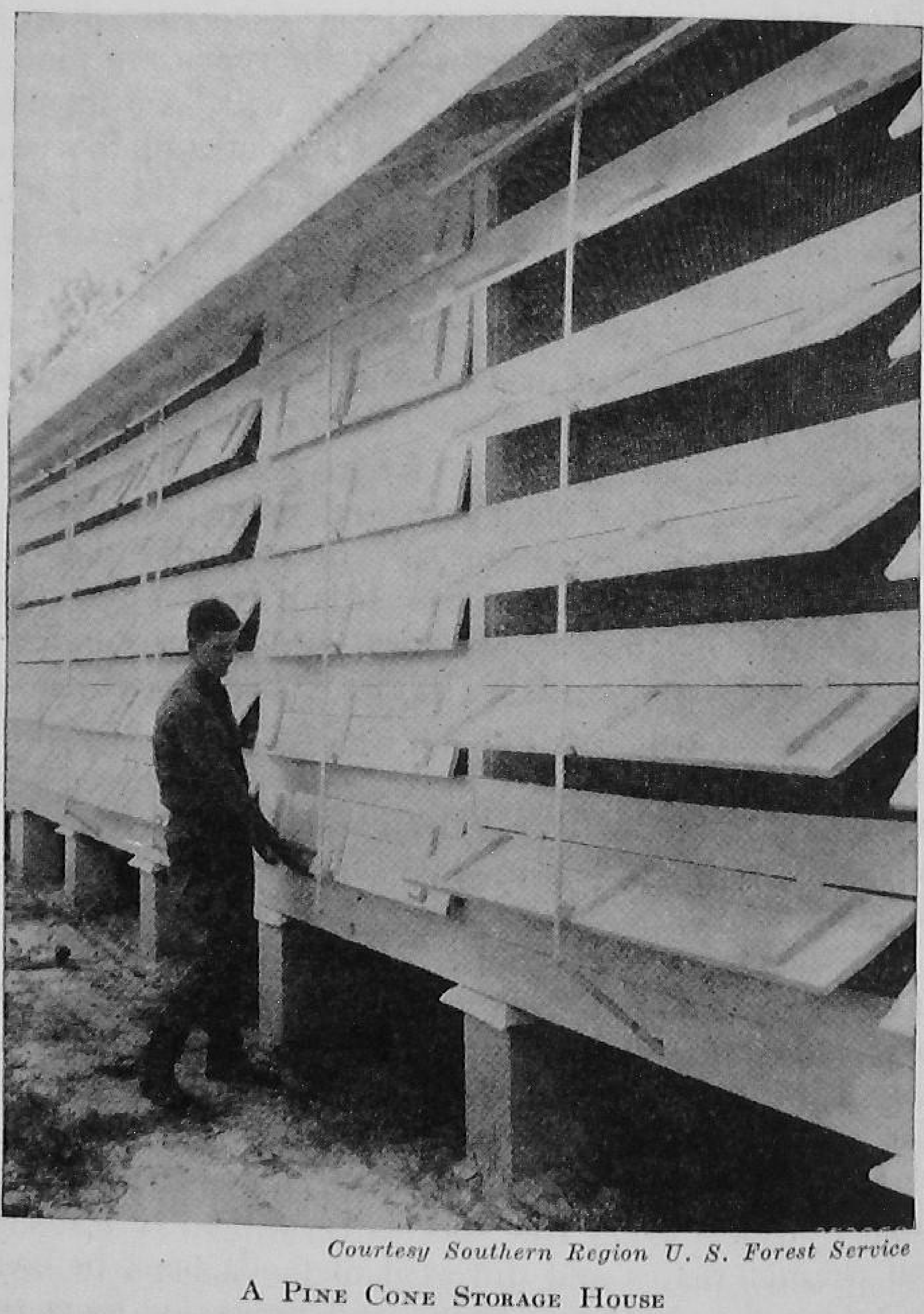
The nut type of seed, which soon dries and shrivels if left to the air, is stored over the winter by the process of *stratification.* This means that the seeds are placed between layers of damp sand, which will keep them in good condition throughout the cold months of the year without drying or sprouting. One year, at Hard Labor Creek State Park, several bushels of acorns were stored in *dry* sand and left over the winter months. Those that did not shrivel and become hard were eaten by the worms. A number of acorns which were thought worthless were thrown behind the storage plant. Some of those sprouted and grew into trees.

Some seeds, like blackgum and magnolia, may be collected by placing sheets of canvas under the tree and shaking the tree branches. It is true that blackgum seeds occur in clusters of from one to three in each cluster, and that the magnolia bears burs in which the red seeds are studded, but the seeds may be shaken off the trees. If the trees are too large for such a procedure, the seeds may be collected from where they have fallen to the ground, but this method of collecting requires a longer time.

The blackgum and magnolia seeds, like many others, must be spread in the sun to dry. After the fleshy part of the seed has shriveled and hardened, the seeds are stored in bags in a cool, dry place until they are ready for planting the next spring.

In collecting any type of seed, judgment must be used. Almost every tree species is marked with different characteristics and different methods must be used in taking the seeds, in storing and preparing them for the seedbeds. The osage orange, for instance, must be

collected and placed in a barrel of water. There it is allowed to remain, with occasional stirring, until the pulpy, golden fruit has rotted. The seeds must then be



Courtesy Southern Region U. S. Forest Service

A PINE CONE STORAGE HOUSE

Ventilating shutters in a storage house at a nursery of the U. S. Forest Service

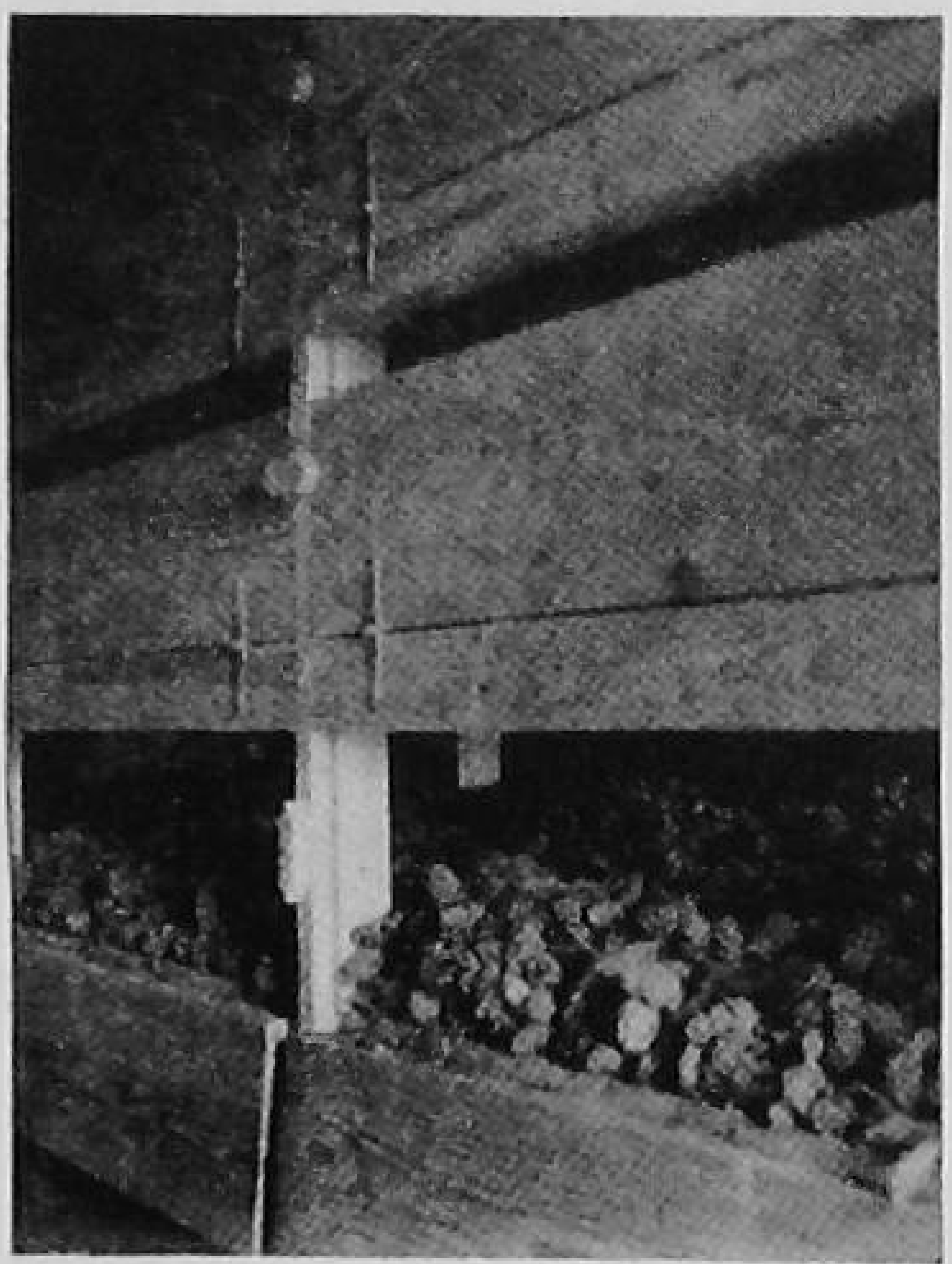
separated from the rotted fruit, which is no pleasant task. The seeds of other fruits, as crab apples, may be collected in this manner. Seeds from the redbud, black locust, and other trees belonging to the legume family, which have seeds in split pods, must be collected in the husk and shelled.

Collecting Pine Seed.—Since the pines are by far the most important trees of the South, the collection of pine seed is important in this discussion. The seeds of pine trees are very difficult to collect, since they must be gathered at the right time and in the right manner. These tiny tree embryos are enclosed in cones, or burs, that are armed with heavy prickles to protect them from enemies until they are ripe. The seeds are nestled close to the center of the bur. The heavy scale which protects them is tightly sealed and hard to remove until the seeds inside are mature. If the cones or burs are allowed to remain on the tree until they mature and ripen, they will open of their own accord and release the seeds to the wind. After the cones have opened, the collection of a large quantity of pine seed is almost impossible.

The seed collector, therefore, must watch the cones until their tips begin to turn brown. Then it is necessary to climb the tree and cut the cones from the branches. A better method is to find a logging operation and collect the burs as the trees are cut. Pine seed mature and the cones are ready to collect in the fall of the year.

When the cones have been collected, they are stored in a cool, dry place, preferably in a warehouse with much floor space. The cones open when dry and close shut when they are wet. If they are stacked in layers of more than two deep, the cones will sweat and remain shut tight until they mold and the seed are worthless.

They must be spread out very thinly on the floor or in bins. As the cones dry, the scales curl back, exposing the seeds. In a small operation, each cone is shaken or beaten against the floor by hand until all the seeds fall out. In a large operation revolving tumblers are used to remove seeds from the open cones. The discarded cones make good fire tinder. A bushel of cones from longleaf, slash, loblolly or shortleaf pine trees will usually yield from one to one and one-half pounds of seed.



Courtesy Southern Region U. S. Forest Service

SHORTLEAF PINE CONES

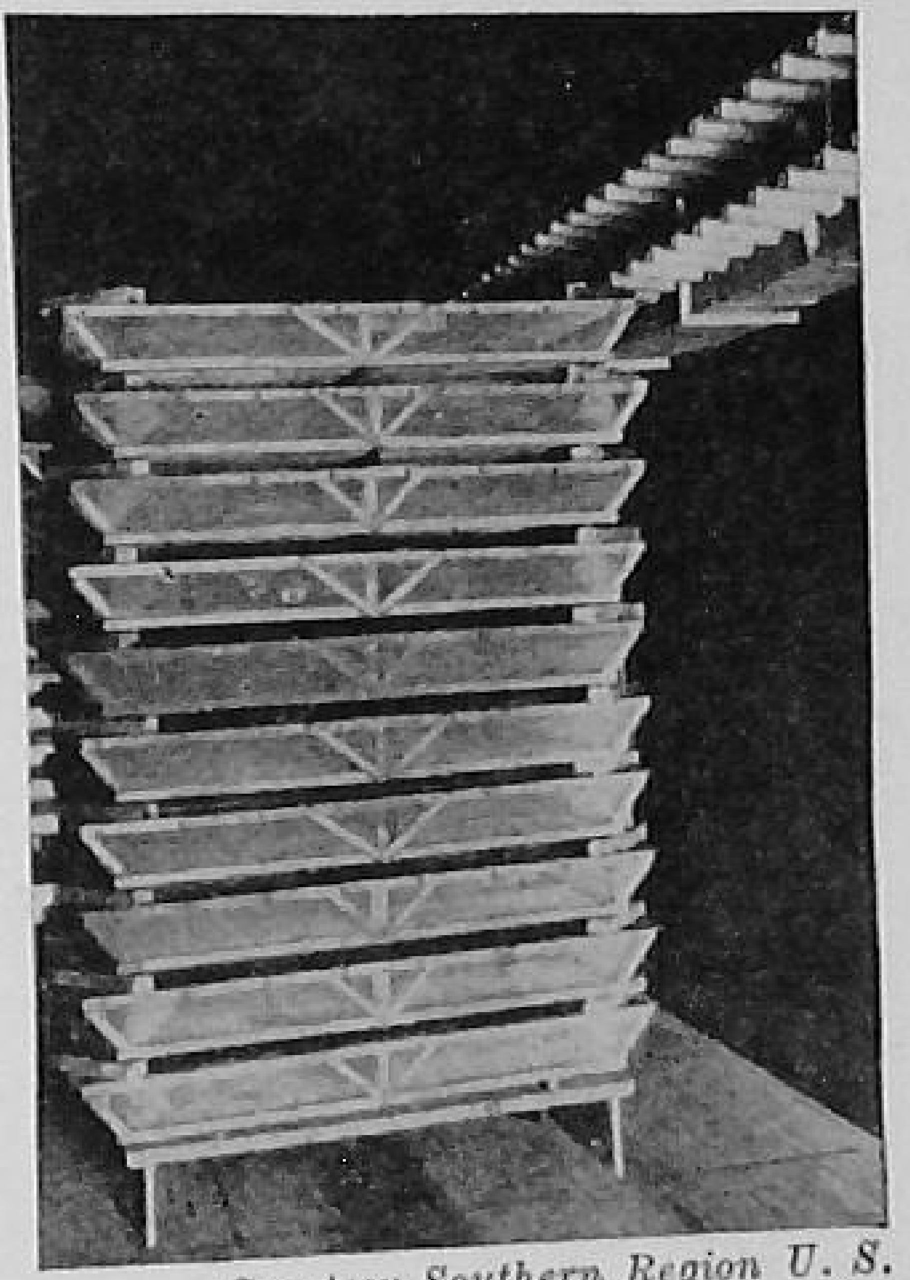
Drying so the seed may be extracted

Wings are attached to the pine seeds to allow them to travel on the wind currents. Those wings must be removed before the seeds are finally and properly clean for sale or planting. After the seed have been separated from the cones, they are held before an electric fan, or in a strong breeze out of doors and rubbed between the hands and allowed to drop downward two or three feet through the current of air. The wind blows the wings and light, trashy seeds which do not have kernels away, and the heavy good seeds fall in a pile on the floor. They are then stored in bags in a cool dry place and are ready to plant the next spring, or even one year later.

The Seedbed.—The next step in growing trees is that of constructing, planting, and caring for a seed-

bed. In order to get the maximum number of seeds to grow in a seedbed, great care must be exercised in handling the bed properly. Seeds and young plants are like any other babies; if they are mistreated or mishandled, they will not survive, and there is no exception to this rule.

The seedbed should be located on fertile, sandy loam type of soil convenient to water. Sand may be hauled in, if the soil where the seedbed is located is too heavy. Generally beds are raised several inches above the surrounding ground, in order that they will drain properly, and are usually boxed in with wooden frames. Those frames are placed from four to eight inches in the ground to keep moles, mice, and other burrowing animals out of the bed, and several inches above the ground in order that mesh wire may be placed in frames over the beds to keep birds from digging up all the planted seeds. For convenience in weeding, watering and removing plants, seedbeds should not be more than four feet in width. They may be as long as the planter finds desirable. An overhead watering system is desirable but not necessary. A sprinkling can may be used, but the larger nurseries either have subirrigation or a network of overhead pipes, where the



Courtesy Southern Region U. S. Forest Service

Trays for Drying Pine Cones in a Nursery Seed House

entire nursery may be watered with minimum expense.

Usually a pound of pine seed may be planted in a seedbed which measures four by twelve feet, or forty-eight square feet. This would be approximately six thousand longleaf, about twenty thousand loblolly or a little more than fifteen thousand slash pine seed planted in forty-eight square feet. The same seedbed would hold less than eighteen hundred black walnut seed. The number of other seeds planted in this space vary according to their size.

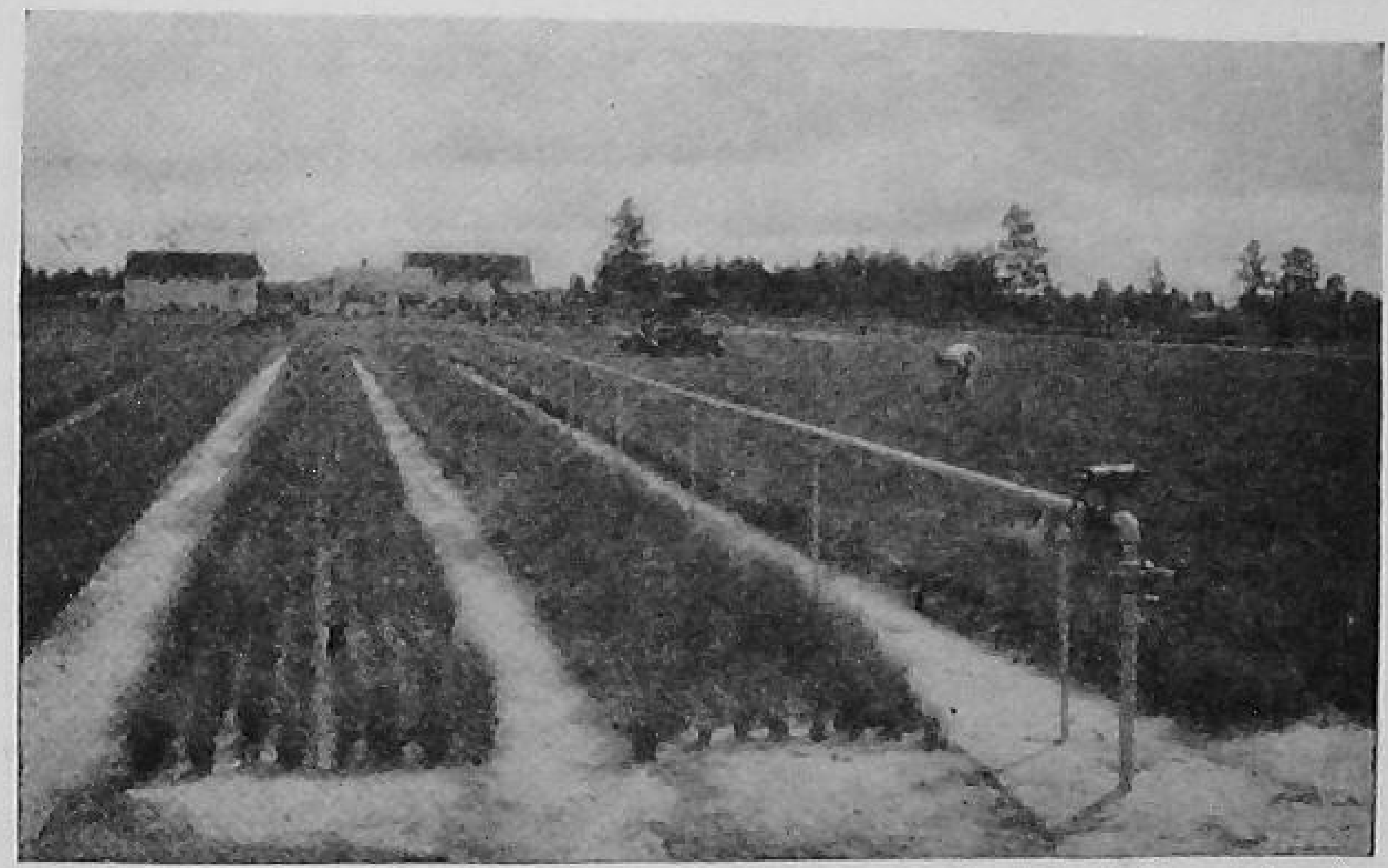
Planting the Seeds.—The seeds may be planted in the seedbed by several different methods. The black walnut and other heavier seeds are planted by being pushed into the sandy soil, until only the top shows. Pine seeds are either sowed in rows, with each row six to eight inches apart, or they are broadcast over the bed. When rows are used, the bed is easier to cultivate and weed. Sometimes after the seed are sowed, sand is sprinkled over them until they are hidden. Another method is to roll the seed into the soil leaving them partly exposed. There seems to be little difference in the per cent of germination by either method.

The seedbed is not fertilized. To do so would encourage the growth of grass and weeds, which would interfere with the growth of the seedlings. The seedbed is kept moist, but not wet, and preferably in semi-shade, where direct sunlight does not fall upon it throughout the day. Sometimes this condition of semi-shade is accomplished by placing slats or a lattice-work frame over the bed, so that shadows move across the bed with the movement of the sun.

The seedbed should never be allowed to become wet or soggy. That condition tends to breed a tree-killing type of disease known as "damping-off." If this disease appears and trees in the nursery begin to die, less

water should be used in the nursery. This disease is common where the growth of plants has been "forced" and the plant cells themselves are weak and watery.

Serious mistakes are sometimes made in planting, especially when the planter has more enthusiasm than knowledge about raising tree seedlings. Not long ago, in a small Georgia town, a landowner, who had recently



Courtesy Southern Region U. S. Forest Service

A U. S. Forest Service Nursery

been the proud purchaser of a farm, decided to plant certain parts of it in trees. He called together his farm hands and put them to work collecting pine cones. After the cones had been collected, he dug holes about six feet apart and in each hole six inches deep he planted a pine cone. Then he sat back and waited for the trees which never appeared.

If he had extracted the seeds properly and sowed them in his fields, the procedure would still have been incorrect. Small, light seeds, as pine, willow, or yellow poplar should be grown in seedbeds and transplanted. If sowed directly to the field they will most likely be

destroyed by birds, rodents, or insects. Larger seeds, planted in the field and properly cared for, will usually survive.

Treating Seeds.—Some seeds, such as black locust, must be specially treated before they are planted. In the woods, under natural conditions they do not sprout before two years or more. This is because of the hard, outer shell, which the kernel must break before the

Courtesy Southern Region U. S. Forest Service

WEEDING LONGLEAF PINE SEEDBEDS

plumule can begin to push its way up through the soil and grow into a tree. Black locust seeds, for instance, may be treated in two ways. They may be placed in hot water, somewhat below the boiling point (about 160° F.) for a few minutes before they are planted, or in a weak acid solution. Both methods tend to soften the shell and allow the seed to sprout in a few weeks.

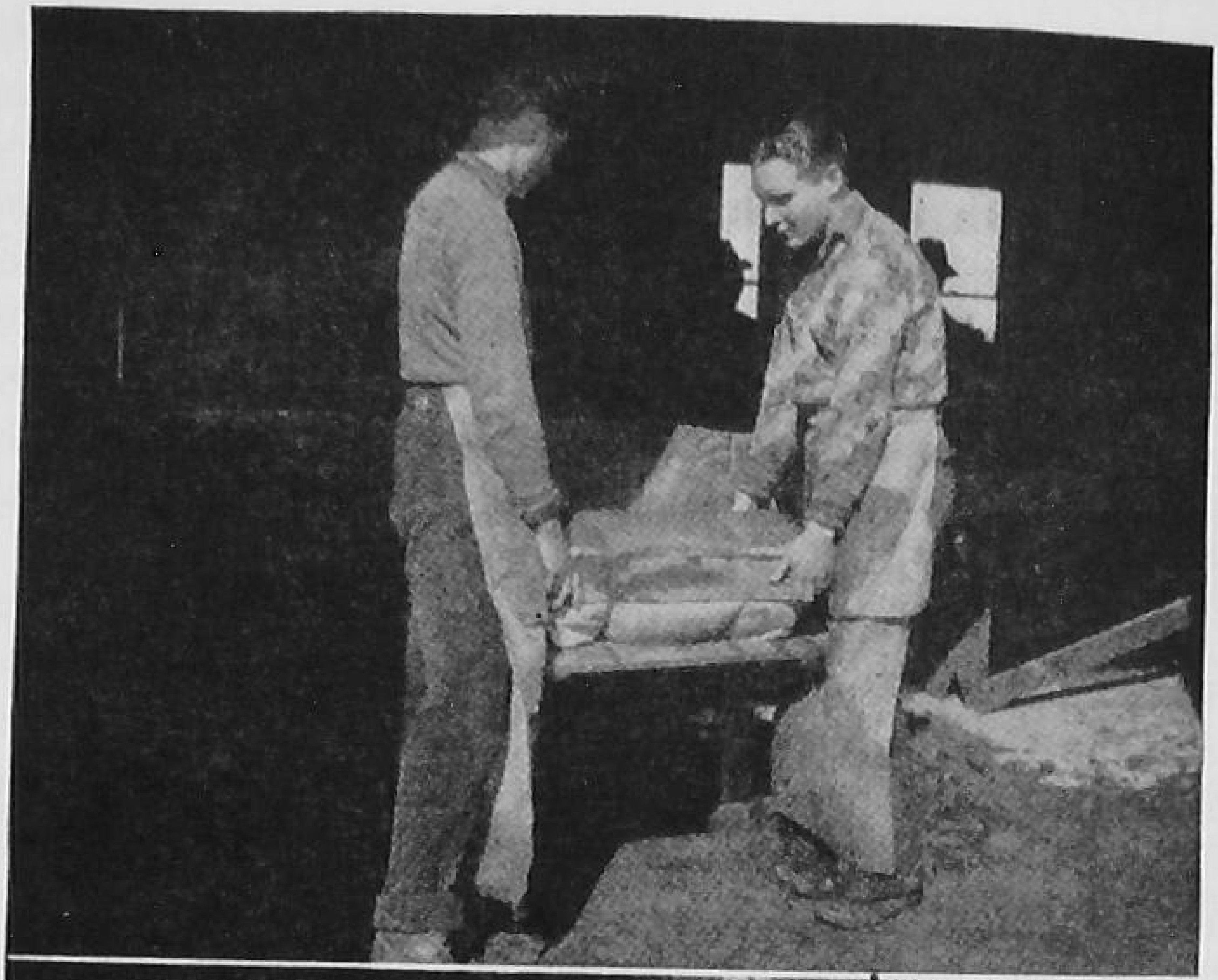
Mechanical methods are also used to bruise and weaken the hard outer shells of some seeds.

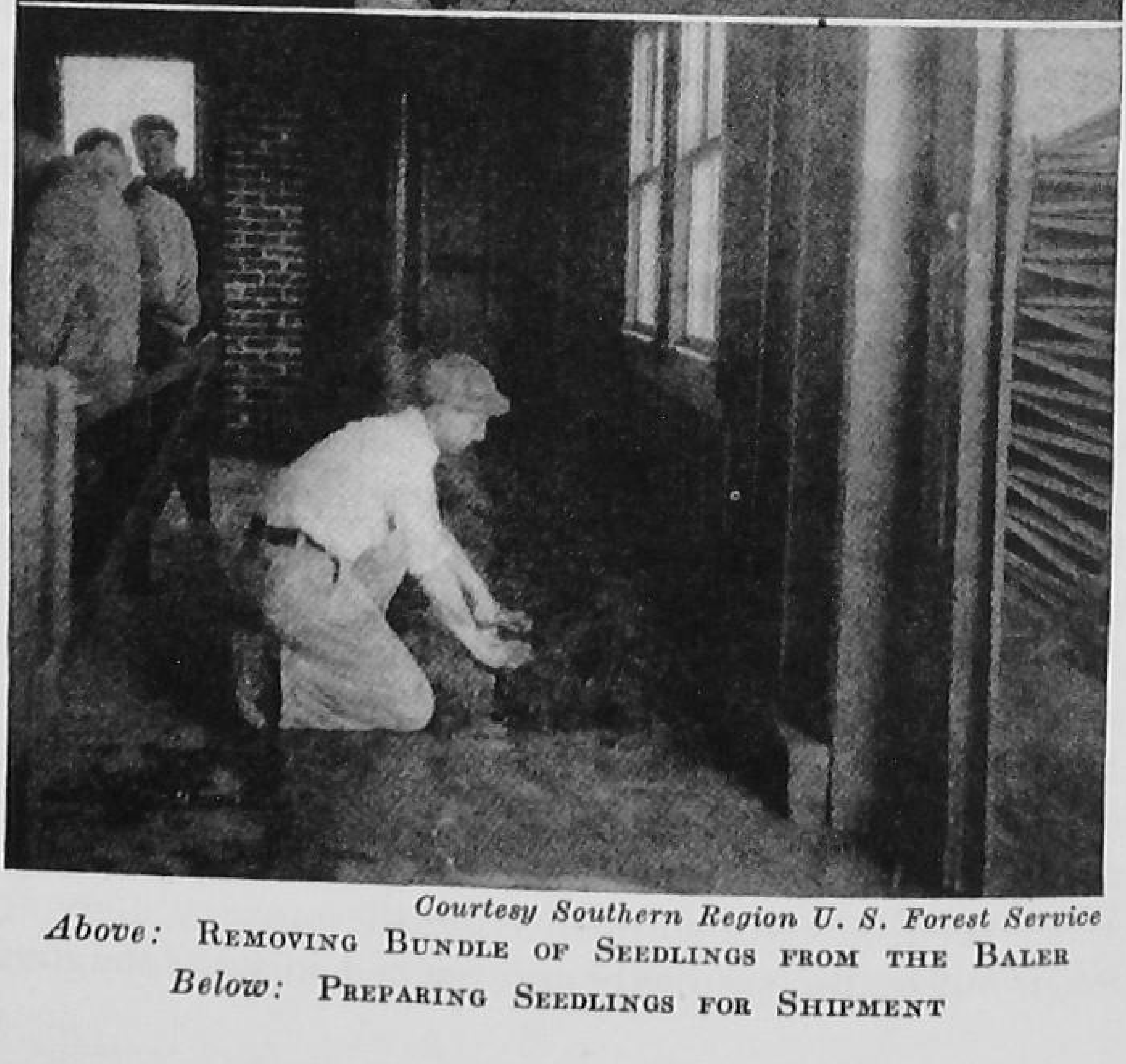
After the seeds have been planted, the bed is usually covered with a mulch. Sometimes burlap sacks are used. After the seeds have sprouted, the sack is raised a few inches above the bed. This allows a weak light to penetrate to the plant. After the plants have become accustomed to this light, the sacking is raised a few inches higher and stronger light allowed to filter in. Finally the sacking is removed altogether.

Natural mulch, like pine straw, is desirable. This straw may be placed one or two inches deep on the bed and the trees allowed to grow through it. This is the natural condition of the woods, and when natural conditions are used they are usually more satisfactory than artificial methods.

Proper Care.—Eventually, however, we find that our seeds, planted in the sandy bed, have sprouted into seedlings. They must have constant care while they are growing into strong, vigorous plants. Birds will pull them out of the ground for their tender shoots. If the seedbed is allowed to become too dry, they will die. If the seedbed is too wet, "damping-off" will attack the young plants and they will not survive. The bed must be weeded, so that the roots will not have competition and have to struggle for all the nourishment they need. With proper care the seedlings will grow into strong, vigorous plants, suitable for transplanting to the field.

In most sections of the South, pine seedlings are allowed to remain in the seedbeds throughout the winter. They are transplanted in early spring when one year old. They are removed when the beds are being made ready for the next planting of the next crop of seeds. When seedlings are shipped from the nursery, they are taken out of the seedbeds and packed in wet sphagnum





Courtesy Southern Region U. S. Forest Service

Above: REMOVING BUNDLE OF SEEDLINGS FROM THE BALER

Below: PREPARING SEEDLINGS FOR SHIPMENT

or some other highly absorbent moss, to keep the delicate roots alive until the plants arrive at their destination and are ready for heeling in or planting.

Seedlings May Be Purchased.—It will be seen from the reading of this chapter that the growing of trees is rather difficult. It is more difficult to grow pine seedlings than it is to grow hardwoods. The reason being that the pines require more water. It is almost essential in a large pine nursery to have irrigation but not so essential in the production of hardwood trees.

Fortunately, those who wish to reforest an area of land may buy seedlings at a very reasonable price.

In recent years practically all state forestry departments have been operating nurseries so that they may have seedlings to distribute at cost. The U. S. Soil Conservation Service operates many very large nurseries. Landowners living in soil conservation districts may buy these seedlings at cost. The TVA operates many forest nurseries for the benefit of the persons living in the Tennessee Valley. Most of the schools of forestry operate nurseries for the training of their students. The seedlings that are produced are sold at cost. And, of course, there are numerous school and community nurseries throughout the South.

The growing of tree seedlings has become a large business in the South in recent years. But, even so, the supply of seedlings has not yet been adequate to meet the demands from progressive landowners.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the more important steps or jobs in the management and operation of a forest nursery?
2. What does the word nursery mean as applied to forestry?

3. Give two ways in which seeds for planting may be secured.
4. At what season of the year may seeds be collected?
5. Tell of some of the forms in which seeds are found.
6. What is meant by *stratification?*
7. Why are pine seeds difficult to collect?
8. When must they be collected?
9. What is done with the cones after they are gathered?
10. How are the seeds extracted?
11. What is done with the seeds after they are removed from the cones? How long will they be viable?
12. How is the ground prepared for planting?
13. Why are the beds raised above the level of the ground? How wide are they?
14. When are the seeds planted? How are they planted?
15. How are they watered?
16. Are the beds fertilized? Why?
17. What care do the young trees require?
18. When are they removed from the beds?
19. What is done with the seedlings when they are removed?
20. What care must be used in packing them for shipment? In preparing them for local planting?
21. What agencies are engaged in the growing of trees in nurseries? What is done with the trees they grow?
22. How much do seedlings grown in a nursery cost a purchaser?
23. Where would you buy seedlings for planting?

Selected References

U. S. Department of Agriculture, Washington, D. C.
Farmers' Bulletins

1123—Growing and Planting Hardwood Seedlings
1453—Growing and Planting Coniferous Trees on the Farm
1628—Growing Black Locust Trees

Leaflets

32—Planting Southern Pine
35—Producing Pine Nursery Stock in the South
84—Planting Black Walnut

Suggested Activities

1. Make a list of all the important trees that grow in your community and determine the proper time to collect the seed of each.
2. Make a study of pines and determine the proper time to collect pine seed.
3. Write to your state forestry department, or some other agency, and learn the location of the nearest large forest nursery. Secure all the information possible about this, and other nurseries in your state, and visit one of them if possible.
4. Collect and store some pine cones at the proper time. Remove the seeds and plant them at the proper time and in the manner suggested in this text. Grow some pine seedlings and at the proper time plant them at your home or on the school property.
5. Consider the advisability of establishing a school nursery for the purpose of growing seedlings for planting in the community.

UNIT VIII—FOREST AGENCIES

Chapter 23

FOREST EDUCATIONAL AND SERVICE AGENCIES

THERE are a number of service and educational agencies engaged in forestry work. Among them are state departments or divisions of forestry; the U. S. Forest Service; state park services; the extension services of the land grant colleges; the forest schools; the National Park Service; the Tennessee Valley Authority; and many private organizations.

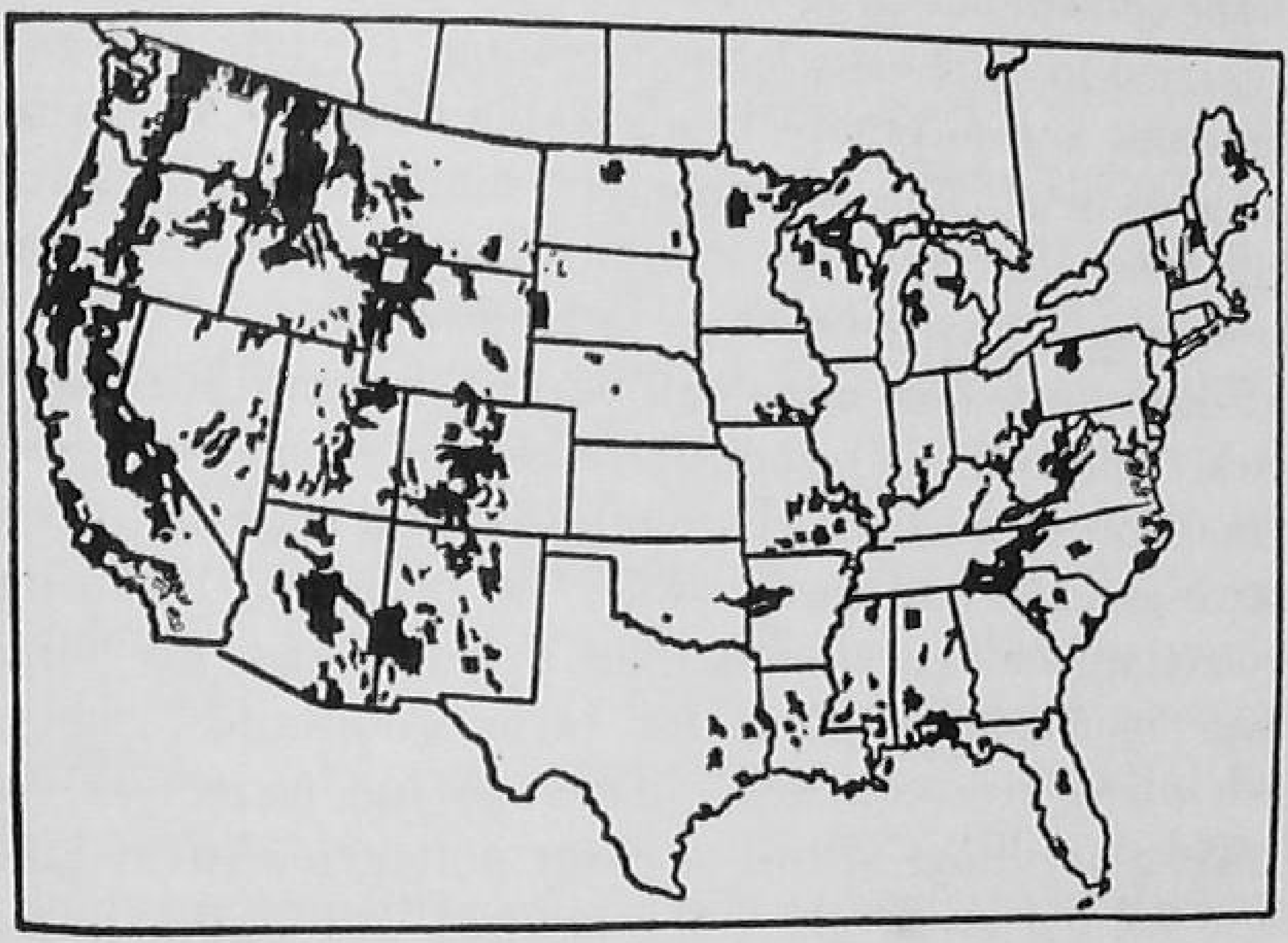
All of these agencies will answer inquiries pertaining to forestry; they publish bulletins and pamphlets dealing with trees, their protection, growth and products; they work with the landowners; and they all conduct studies and investigations related to our forest resources.

Through the leadership of such agencies we are, as a people, becoming forest conscious. We are learning about conservation and forest management. Every well informed person should know something about the work of these agencies.

State Forest Services.—Every state in the nation with a large area in woodland maintains a state forest service. In some of the states, these are separate departments. In others they are divisions of departments of conservation or of natural resources.

At the head of each of these services there is a *state forester*. Many of the states also have *division* or *district foresters*, who serve within restricted territories.

The activities of the state departments of forestry are wide in scope. In general they practice and promote efficient forest management. More in detail the range of their work covers all phases of forestry from teaching to the actual harvest and sale of tree products.



National Forests and Purchase Areas in the United States

Through their branches of information and education, most forestry departments in the southern states maintain close contact with the schools and other youth organizations. Particularly is this true of such farm groups as the 4-H clubs and vocational agriculture classes.

These organizations are furnished bulletins, booklets and pamphlets. They are shown movies of forests and forest life, where such practices as correct lumbering and logging, saw-milling, thinning, planting and other intensive forestry, are stressed. Specialists are sometimes provided by the department to meet with classes and groups to lecture on forestry and its various activities.

In many states, the departments sponsor a summer camp for young farmers, landowners and foresters, where such subjects as tree identification, the elements of timber cruising, planting and other basic forestry lessons are taught.

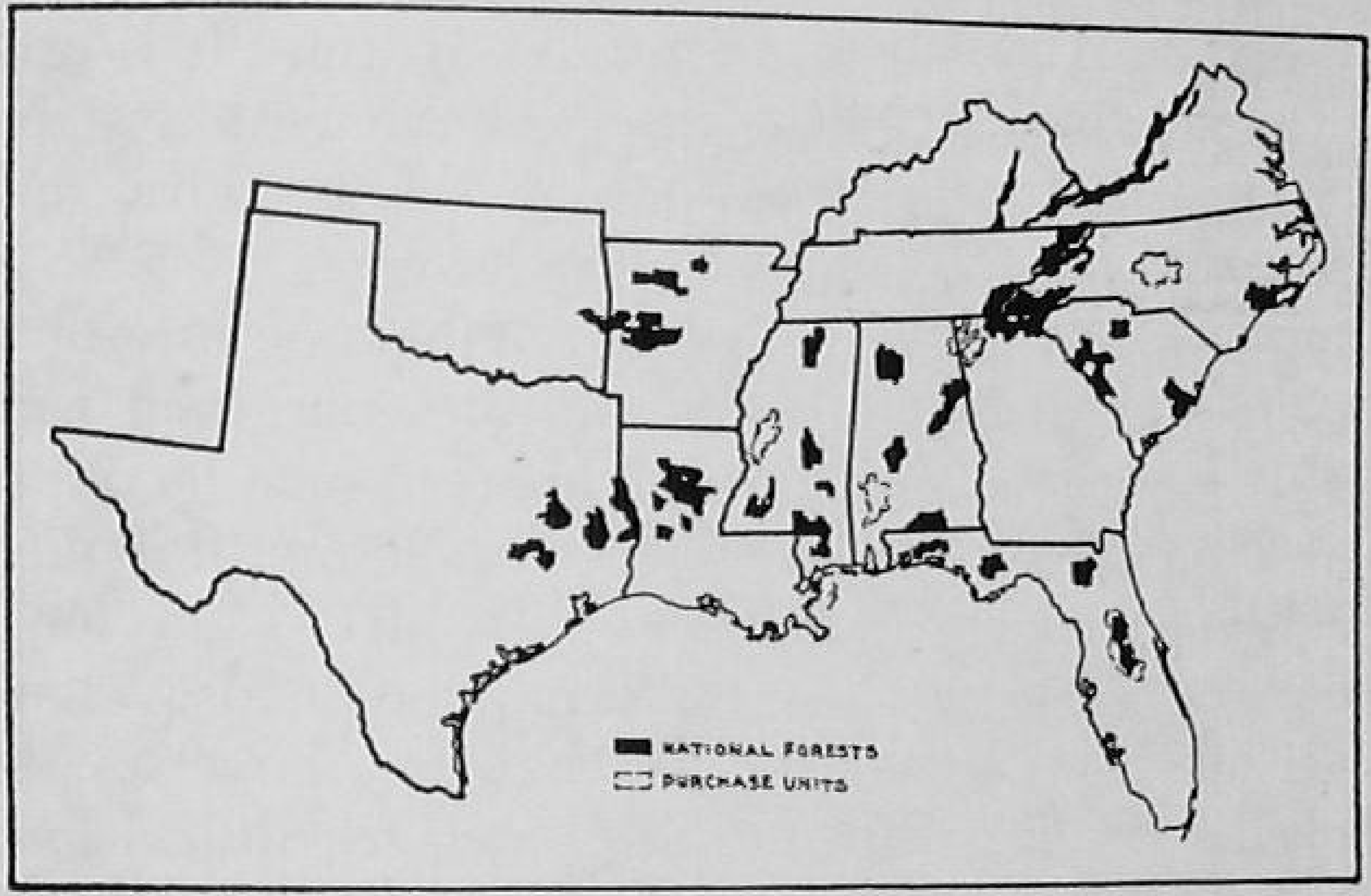
The educational program is projected even further. It is carried to farm association meetings, to civic and garden clubs and to groups in all walks of life. It is promoted as news items in the papers, interviews, plays and skits over the radio, as exhibits in county fairs, and through informative bulletins to landowners.

Education is only one small part of the state forester's work. Most of his responsibilities are concerned with actual forest practice. Through his field men he offers active assistance to forest owners in planting, thinning, protecting and harvesting trees. He draws up long-range management plans for farm woodlands, where such plans are requested. Through his nurseries, he provides seedlings at cost to cover nonagricultural land or to fill out areas where the natural restocking is too thin. He gives advice on fire breaks, on controlled burning, on turpentining and he helps to find a market for the various types of raw products which come out of the woods.

Most state departments own forests, which are public property and where good management practices are demonstrated. Here accurate records are kept on the growth of various species, on the quality of timber harvested, and on the various methods of thinning and cutting. These records are open for inspection to all timber growers, and are periodically published for those who do not have the means, or are too far away to visit the state forest.

Most state departments work with their counties, parishes or other subdivisions within the commonwealth, for

fire protection and control. They supervise the expenditures of Clarke-McNary funds for such purposes as fire towers, fire breaks, county operated fire trucks, radio systems and other equipment and personnel who work to save the landowner and citizen many thousands of dollars which would otherwise go up in smoke each year.



National Forests and Purchase Areas in the South

Some of the state forests provide recreation for the people who live around it, in the form of hunting, fishing, swimming or picnicking where special sites with water, tables, outdoor fire places and other accommodations are furnished for pleasure and health.

Each year the state forest services publish annual reports reviewing their work. These bulletins are very interesting and should be studied by those persons within the states who wish to secure information relative to forestry development.

The U. S. Forest Service.—The U. S. Forest Service is a bureau in the United States Department of Agriculture.

The Service normally employs about 3,000 full-time workers, but during the fire season adds about the same number of temporary workers.

Headquarters of the Service are located in Washington, D. C. The nation has, however, divided into ten *regions*, or administrative districts with an office and staff of workers in each. Regional offices serve a definite portion of the nation.

The office of Region 8, known as the Southern Region, is located in Atlanta, Georgia. The states included in this region are: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas. It also includes Puerto Rico.

Kentucky, Virginia, West Virginia, and Maryland are located in the Eastern Region, which has been designated as Region 7.

The Forest Service is charged with the responsibility of promoting the conservation, protection, and wise use of the country's forest resources in the public interest. Its activities embrace three major fields of work: (1) the administration of national forests and publicly-owned forest lands bought by the Federal Government; (2) cooperation with the states and with private land-owners in securing protection from fire, in reforestation, and in management of forest lands; and (3) forest research looking to improved methods and practices in protection, management, and utilization of forest resources.

There are 157 national forests in the United States, including Alaska and Puerto Rico. These forests contain more than 165,000,000 acres. In addition, there are as many more Federal purchase areas, which at some later date may be included in new national forests. All this land is managed and supervised by the Forest Service.

These national forests contain one-third of the remaining saw timber of the country. It is the policy of the Forest Service to permit the cutting of the timber by private agencies, but only such trees may be cut as are marked for harvest by the Federal foresters.

STUDENTS IN A SCHOOL OF FORESTRY

Testing the strength of wood

The same policy which prevails with respect to cutting timber from the national forests applies in all useful products produced within the forest areas. The forests are managed in the interest of public welfare. For example, there are excellent grazing lands in some of the forests. Livestock owners may secure permits to graze

this land. During specified seasons of the year there are approximately 14,000,000 head of livestock grazing on national forest land. These cattle and sheep belong to individuals and private corporations.

Annually more than 25,000,000 people visit national forests. Nearly 5,000 free public campgrounds have been established.

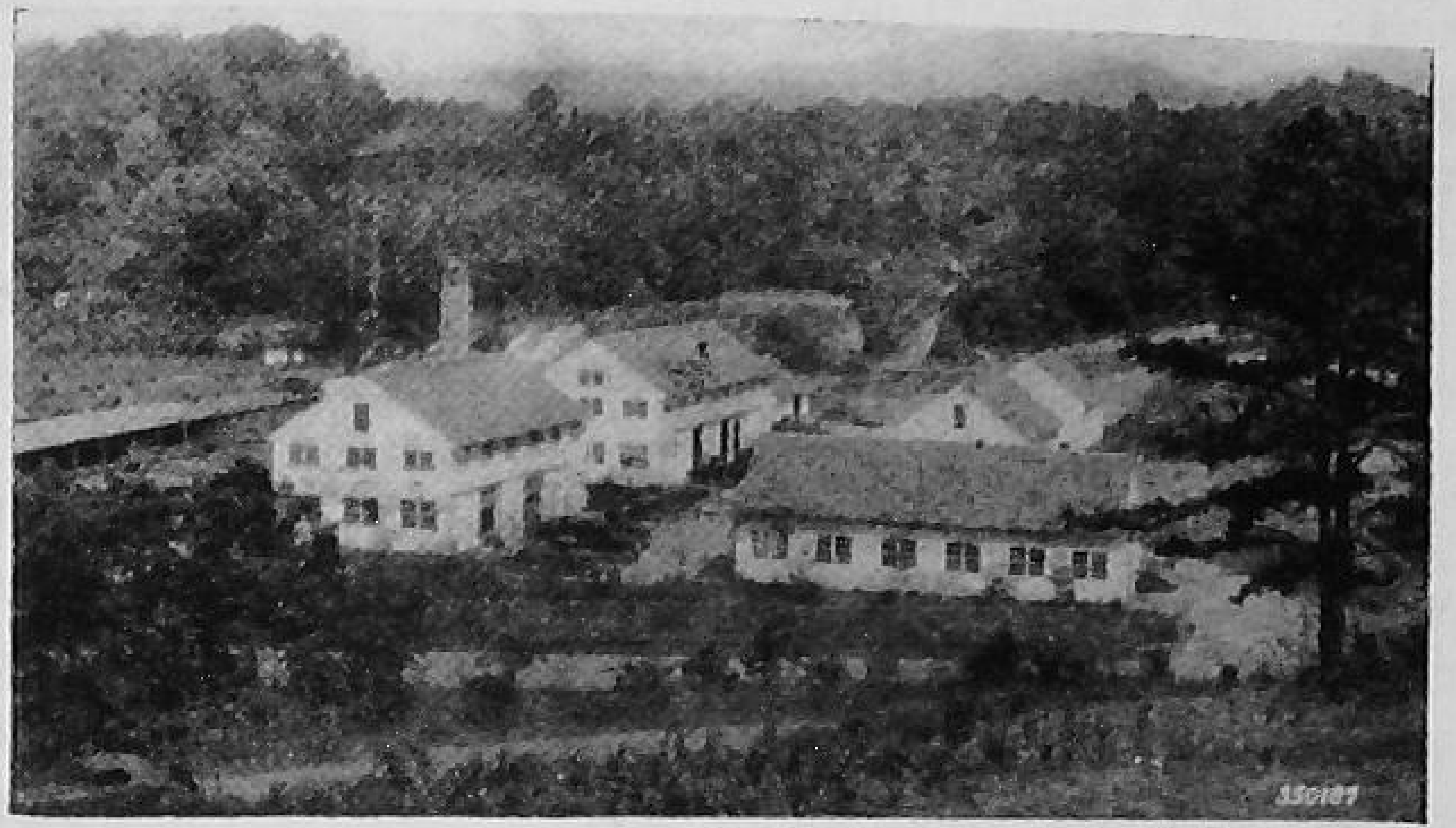
Each national forest has a supervisor in charge. The forests are divided into ranger districts varying in size from 100,000 to 300,000 acres, with a forest ranger in charge of each.

The national forests constitute an important part or unit in the economy of the nation. They aid in the control of floods by slowing up the run-off of water; they protect wildlife; they conserve our most valuable saw timber; they take "poor lands" out of cultivation; they provide recreation for the people. As the years go by, the people of America are beginning to realize that these forests belong to them and they are taking advantage of the opportunities the forests provide for their recreation.

The U. S. Forest Service conducts extensive research work in the field of forestry. There are twelve forest *experiment stations* maintained throughout the nation. One of these, the Southern Forest Experiment Station, is located at New Orleans.

All technical workers employed by the U. S. Forest Service are secured through civil service examinations. This means that when the Forest Service wishes to employ any person to fill a position that is open, an examination is announced by the Civil Service Commission and any citizen who desires to do so may take the examination. The announcement of the examination always states the qualifications for the position. For the most part, the better positions are filled by young men who are graduates of the four-year forest colleges and schools of

the nation. Information concerning examinations in forestry will be sent to anyone on request. Those persons interested should write the U. S. Civil Service Commission, Washington, D. C.



Courtesy Southern Region U. S. Forest Service

WAREHOUSE AND SHOPS OF U. S. FOREST SERVICE

Pisgah National Forest

State Park Services.—In practically every southern state there is now a state park service. This service agency is either a part of the state forest service, or works in close cooperation with it. States in all parts of the country are beginning to acquire forest and park land. They are doing this in the interest of conservation and recreation. They are also interested in wildlife in connection with recreation. But they have in mind also the experience of the older nations of the world that have acquired forest areas as a source of funds. It is not unlikely that in the years to come, the amount of land owned by both the Federal and state governments will be increased. This land will be developed primarily for recreational purposes, but, incidentally, over a long period of years, it will doubtless become a source of income.

In several states of the nation, notably Wisconsin, New York, and Michigan, definite plans for zoning rural areas have been developed.

We have long been familiar with zoning in progressive cities. This means, as one example, that business establishments cannot be erected in certain restricted residence districts, or that in certain sections of the city, houses must be of a certain size or cost.

The same idea is being developed in connection with rural areas. It means, when applied to the open country, that schools, and other public services, cannot be maintained in certain sparsely settled districts, which should be given over to forests. Such determinations or decisions are made as the result of planning by state and national agencies.

State park services and state forest services will manage such land, just as the U. S. Forest Service operates the land in national forests.

Extension Foresters.—In every state in the nation there is an agricultural college known as a land-grant college. The name comes from the fact that in the beginning, to encourage the establishment of agricultural and mechanical colleges, the Federal Government gave each state an area of land as an endowment for such an educational institution. All these colleges receive Federal funds.

Each land-grant college maintains an extension service, in cooperation with the U. S. Department of Agriculture. The extension service personnel consists of county agents, home demonstration agents, and other persons including subject-matter specialists. Each of the southern agricultural colleges employs an extension forester.

It is the duty of the extension forester to bring educational information to the people of the state. This is

done through bulletins, demonstrations, talks, lantern slide lectures, and motion pictures.

Often such extension specialists will visit schools for the purpose of presenting information about forestry.

Courtesy Southern Region U. S. Forest Service

Picnic and Camp Ground

An invitation from the Forest Service

Forest Schools.—Forestry education is new in America. Prior to the opening of the century there were no colleges of forestry in this country. Our first American foresters were trained in the schools of Europe.

In recent years, however, much attention has been given to forestry education of a professional grade.

There are in the United States about 25 forestry colleges giving a four-year course. A list of these schools may be obtained from the U. S. Forest Service, or from the Society of American Foresters, Washington, D. C.

The oldest forest school in the South is the George Foster Peabody School of Forestry at the University of Georgia. There are schools of forestry in North Carolina and Louisiana. Florida has a department of forestry in the University at Gainesville. The Southern Association of Agricultural Workers has requested that at least one course in forestry be required for all students in agricultural colleges. Such courses are now being offered.

For a number of years the teachers of vocational agriculture in the rural high schools of the South have taught a course in forestry. F. F. A. boys have conducted forest projects. Many of these schools have their own school forest.

In recent years forestry has been made a required course in the public schools of some of the southern states. This requirement is destined to be extended to other states. Schools are beginning to give more consideration to a study of natural resources. Since trees occupy more than fifty per cent of the land of the South, no study of natural resources is complete without some study of forestry.

The Soil Conservation Service.—The Soil Conservation Service employs foresters. It is the duty and responsibility of this service to aid farmers in the control of soil erosion. To control erosion a portion of the land on most farms must be planted to trees. In the soil conservation districts, maps are made of all the farms in the area for the purpose of determining the proper use of every acre. In connection with this work, the Soil Conservation Service has prepared educational literature showing the place of trees in the conservation of the soil.

The Tennessee Valley Authority.—The TVA, as it is commonly called, was formed for the purpose of

controlling the run-off of water on the watershed of the Tennessee River, and for other related purposes. All related purposes are incidental to this major conservation objective. In carrying out its work the TVA employs foresters and extends an educational service in forestry to the residents of the Tennessee Valley, which embraces parts of seven states. In carrying out its objectives the TVA usually works through other agencies, such as the agricultural Extension Service.

New Emphasis.—All agencies engaging in forestry work are relatively young in years. This is a new emphasis in public affairs. Until a few years ago, we, as a people, had little interest in conservation. Now, however, we have come to realize that we have been destroying our resources and that they must be replaced and maintained so far as this is possible. The work of the forest educational and service agencies will continue to expand. We are becoming forest-minded. Our people are beginning to realize that generations of American citizens yet unborn will need trees, and that those now living will find them a source of income and pleasure.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Name some of the forest educational and service agencies.
2. What types of services are common to all these agencies?
3. Tell something of the work of the state forest services.
4. How are state departments of forestry organized? What do they do?
5. List five fields of work in which state forest services engage.
6. Explain, in general, the work of the U. S. Forest Service.
7. In what district or region of the U. S. Forest Service do you live? What other states are in the district?
8. What are the three major fields of work of the U. S. Forest Service?

9. What is meant by a *national forest?* By a *Federal purchase area?*
10. Does the Federal government own much forest land in your state?
11. How many national forests are there in our country?
12. What are the benefits to be derived from the ownership of land by the Federal government? Are there objections to the Federal ownership? What are they?
13. How are workers for the U. S. Forest Service employed?
14. Discuss the work of the state park services. How are they related to forestry?
15. What is meant by land zoning? What are the purposes and benefits?
16. What is the agricultural Extension Service? What do extension foresters do?
17. Discuss college degree courses in forestry? Where are such schools and colleges located? What are the requirements for graduation?
18. Tell something of the work and objectives of the Soil Conservation Service. How is this related to forestry?
19. What is the major objective or purpose of the TVA? What are some of the activities carried on by the TVA?
20. Do you agree with the thought that forestry services will continue to grow in the future? Why?

Selected References

U. S. Department of Agriculture, Washington, D. C.

Work of the U. S. Forest Service (A mimeographed statement.

Annual Reports, U. S. Forest Service.

Material of interest to Teachers (A mimeographed list of available material).

Annual Reports, Soil Conservation Service.

State Publications

Annual Reports (and other bulletins) of your state forest service.

Catalogs, Schools of Forestry.
Bulletins of Extension Service, colleges of agriculture.

Suggested Activities

1. Write a letter to the Regional Forester, Atlanta, and ask for reports dealing with the work of the U. S. Forest Service. Persons living in Virginia and Kentucky should write to the Regional Forester, Washington, D. C.
2. If your school library does not contain a recent report of your state forest service, write for such a report, and other bulletins.
3. Write to the headquarters of all agencies mentioned in this chapter and secure literature dealing with the work of the agency.
4. Write a paper on the subject: The Work of Forest Agencies in My State.
5. If possible, visit any place where work has been done by any of the agencies mentioned in this chapter.

CHAPTER 24

OCCUPATIONS IN FORESTRY

ONE summer John Coulter visited Pisgah National Forest.

It was a delightful place in which to enjoy a vacation. With his father and a younger brother, William, and some of the boys from William's near-by scout camp, he followed the most inviting trails. They marvelled at the giant trees and admired the luxuriant ferns, laurels, and rhododendrons which were so thick that it was almost impossible to go through them.

"Why do plants grow so big here, and why do they look so green?" William asked his father.

"Perhaps that gentleman can tell us," suggested John, indicating a handsome man in an attractive uniform, who was coming toward them.

"I shall be delighted to do so," replied the stranger. "It is on account of the abundant rainfall, the long growing season, and the fact that the trees and plants hold so much of the rain that falls in the Forest. It rains very often, as doubtless you have observed. And yet the showers come and are over in a few moments. It is our rainfall and the delightful climate which produce such magnificent plant life. It is beautiful, isn't it?"

As soon as he had passed on, William asked, "Who was that man?"

"He is one of the forest rangers employed by the U. S. Forest Service," replied the boy's father.

They walked on in silence for a moment, and then William said, "You know, Dad, when I grow up, I believe *I'll* be a forester."

This momentary decision of William's was made, of course, without knowing much about the field of forestry, or the work of a forester. But forestry appeals to

Courtesy Southern Region U. S. Forest Service

IMPROVING A LOG DAM

Every effort is being made to provide excellent fishing in Southern National Forests

boys. They like the outdoor work; the call of conservation service attracts them; and they respond to the opportunity to manage large tracts of land.

Today we have more young men preparing to enter this group of occupations than ever before in our national life, but no boy should make a final decision before studying the scope of forestry work.

"A forester is not necessarily a man who wears a regulation uniform and climbs towers looking for fires," we are told in a book published by the Federal government. "He may be a business man working in a modern office. He may be a supervisor who drives an automobile over forest roads inspecting the woods work. He may be a teacher in a college, a writer, a lumberman, or a manu-

Courtesy Southern Region U. S. Forest Service

GAME REFUGE SERVICE OFFICE

Pisgah National Forest

facturer of wood products. A forester may be far from cities in isolated mountain regions where he works on his assignments and protects the forest assigned to his care. Whatever his job may be, he is a man who knows about forest problems and how to meet them. He knows the value of trees and what they mean to man."

This statement suggests the variety of work done by

men known as *foresters*. Those who are interested in the work, as well as those seeking general information, should study the occupations in forestry. Such persons will want to know in detail what foresters do, something of the conditions under which they work, training requirements, and opportunities for employment.

What Does a Forester Do? In the earliest period of professional forestry, the principal duties of those engaged in the occupation dealt with forest protection and tree planting. Now there are a number of specialized phases of the work including those in the outline entitled *Professional Work With Forests.*

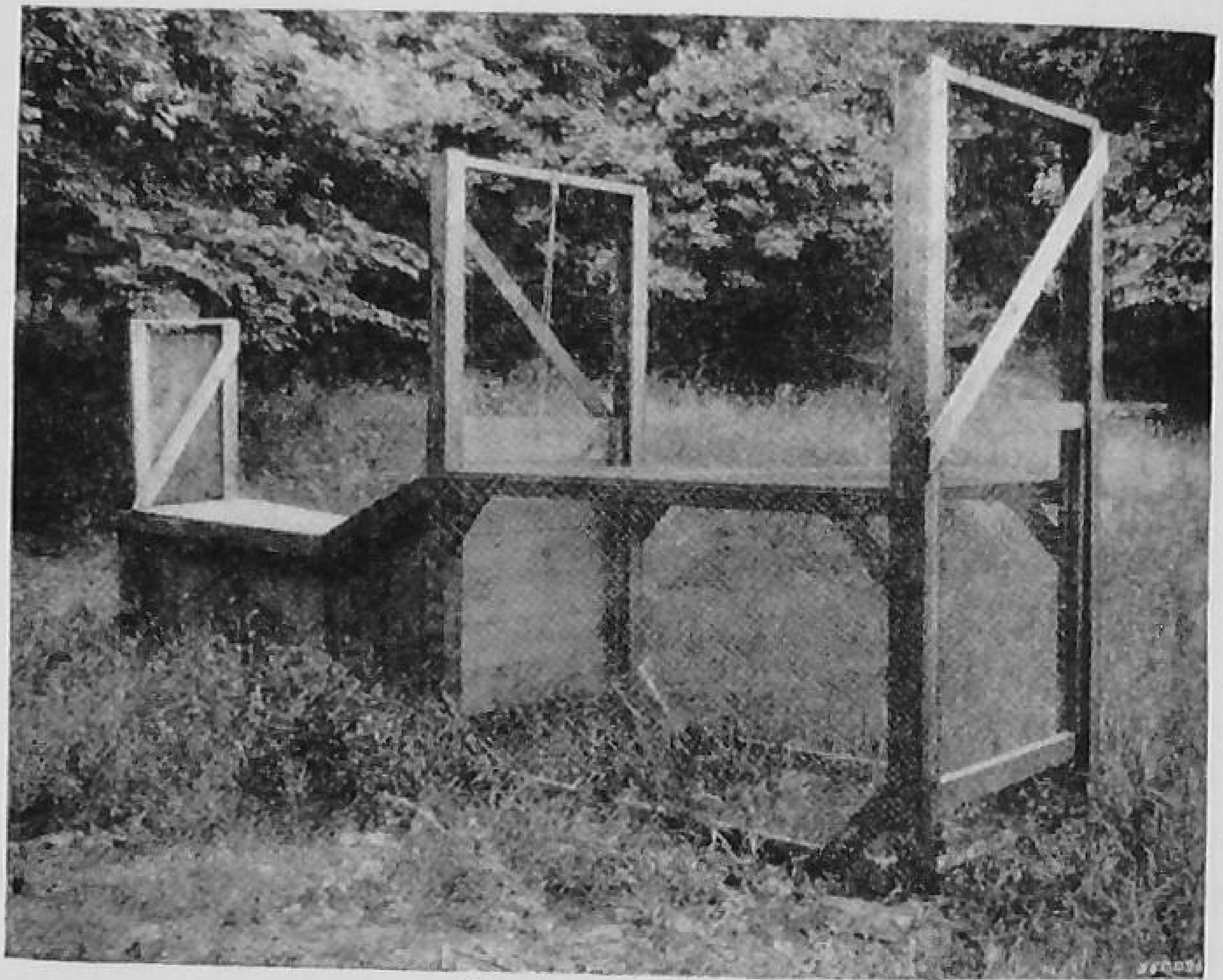
PROFESSIONAL WORK WITH FORESTS

Activities of a Forester	*Examples of Work Done*
1. General Administration	a. Determining forest policies and developing programs of work.
2. Forest Protection	a. Preventing forest fires
	b. Controlling insect pests
	c. Checking tree diseases
3. Silviculture	a. Operating forest nurseries
	b. Planting forest trees
4. Forest Management	a. Estimating standing timber
	b. Mapping forest areas
	c. Selling timber
5. Forest Engineering	a. Building forest roads and trails
	b. Surveying boundary lines
6. Forest Utilization	a. Logging and lumbering

The six divisions of professional work with forests do not, of course, exhaust the employment opportunities for the professional forester. These divisions do not consider, for example, occupations in the field of research, education, or industry. These will be considered under employment opportunities. Beginners, or boys making

a survey of the occupational field are more concerned with the places and conditions under which forestry work is conducted.

Working Conditions.—A forester may spend much of his life in remote regions. He often lives alone or



Courtesy Southern Region U. S. Forest Service

A Deer Trap

Used in connection with the work on the game refuge at the Pisgah National Forest. Often deer are caught and moved from one forest to another when an area becomes over-stocked

with a few helpers. He is often in the woods not only in the pleasant months of summer, but during the cold months of winter as well.

"I do not like this forestry work," said a young man who had returned to the city after a try-out in land acquisition work. "I did not get to the picture show while I was on the job. Only on weekends did I get out of the woods, and then the town we visited was just a trading

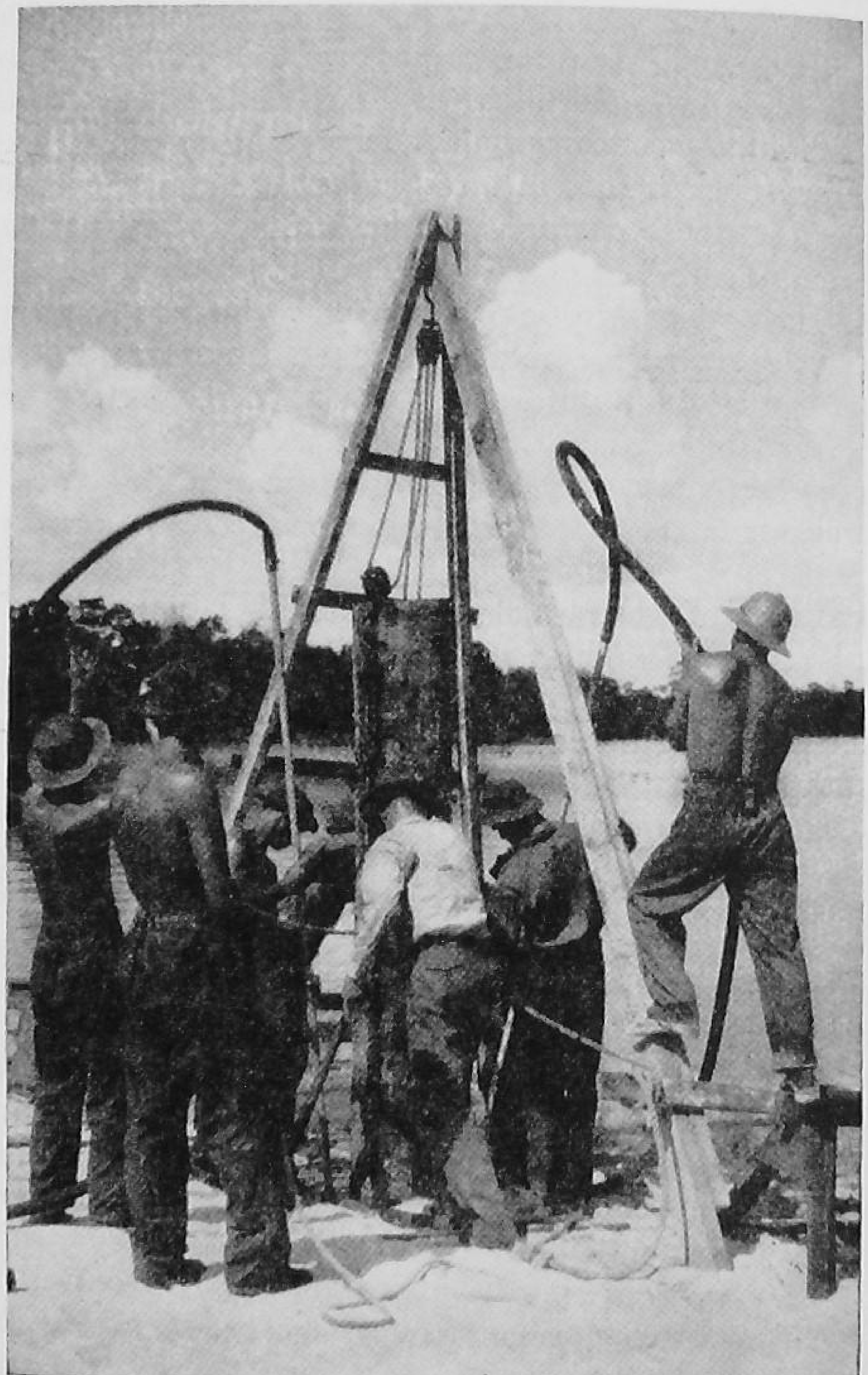
post with a store and a few houses. I've had enough."

A genuine love for the outdoors and the ability to provide one's own entertainment are perhaps prime requisites for those entering upon the work of forestry. There are swivel-chair jobs in forestry just as in other occupations; but these positions are held for the most part by men who have served an apprenticeship in the forest.

"The young forester is apt to have his headquarters shifted frequently, somewhat like the civil engineer," we are told in the publication of the U. S. Department of Agriculture entitled, *Careers in Forestry*. "The places to which he is assigned may not always be the most desirable from the standpoint of personal comfort and convenience, especially for family life. Because of this shifting about, he may be unable for some time to establish a home. On the other hand, if he is an able man, he may ultimately advance to a position which will give him more permanent headquarters and greater opportunity for home life. He must not count himself secure, however, against a change of working field which will necessitate removal to a new place. Ordinarily, his home will be in a small town or its vicinity.

"Even in the higher positions, whether in government or private work, the forester may have to spend a great deal of time supervising or inspecting actual field operations. Trips away from his headquarters may be for a day or so, or for several weeks. In some positions such travel often includes long, hard journeys by horse and pack train. Frequently it means rough walking, and sometimes days of hard and slow progress by snowshoe or canoe. Even with the greatest possible extension of good roads, much of the forester's travel for many years will necessarily be arduous."

Training for Forestry.—Our first foresters in the United States were trained for the profession in Europe.



Courtesy Southern Region U. S. Forest Service

PLACING PIER PILES

The year 1898 marked the beginning of scientific forestry education in America. In that year the College of Forestry at Cornell University was established. Two years later the Yale School of Forestry was created, and, in 1903, the Department of Forestry was organized in the University of Michigan.

At the present time there are about twenty-five "Forest Schools" in the United States. All approved schools and colleges offer a four-year degree course. The degree obtained is usually that of **Bachelor of Science in Forestry.** In addition to attending the regular school session of nine months each year, students in forestry are required to secure practical training and experience in forest camps. A list of the accredited forestry schools of the nation may be obtained from the Society of American Foresters, Washington, D. C.

Courtesy Southern Region U. S. Forest Service

A Ranger and His Dog

Several schools and colleges offer one-year and two-year courses for those who wish to prepare for special fields of work in forestry. Such men do not, of course, secure a degree in forestry; they are *technical*, rather than *professional*, foresters. The U. S. Forest Service

holds training schools from time to time for those who wish to become forest rangers, fire wardens, forest inspectors, radio operators, road construction foremen, erosion-control engineers, or qualify for other related jobs.

Employment Opportunities.—Employment opportunities for professional foresters, which will always be limited in number, may be divided into two groups—public service and private service. Public service includes positions with the Federal government and jobs with cities, counties, and states.

Federal Positions.—Several agencies or branches of the Federal government employ foresters. Among these are the following: U. S. Forest Service, Office of Indian Affairs, National Park Service; Fish and Game or Wildlife Commission; Bureau of Foreign and Domestic Commerce; Tennessee Valley Authority; and the Soil Conservation Service.

Federal positions pay well. Beginners, just out of college, receive $2,000 or more annually; top positions pay as much as $10,000 a year. Each year in Federal service, salary increases are granted in accord with a fixed scale.

Government service has many attractive features other than salary. One of these is provision for retirement. When employees attain the age of sixty, or older, they may retire and receive compensation that will enable them to meet living costs in a satisfactory way. More and more, however, retirement or old age pensions are provided by all employers both public and private.

Also, professional employment with the Federal government is protected by civil service regulations. These provide, in general, that an employee may not be discharged for reasons other than unsatisfactory work. In other words, the positions are fairly secure.

State and Local Governments.—Virtually all states maintain departments of forestry. These departments employ trained foresters. The number of positions has been increasing for many years; in fact, ever since the first state departments were created.

Agricultural experiment stations in many states employ foresters. Also, there are positions with the agricultural Extension Service both at state and county levels. Some cities employ foresters in their park and recreation departments.

In initial jobs for beginners, cities, counties, and states pay as well as the Federal government. Some localities may pay even more. But, as a rule, top positions in local government, except for the larger cities, do not pay as much as those in Federal service. This need not concern the young man entering upon a career. After all, it is well to remember that in any field of work—public or private—few persons are found in the highest salary brackets.

Private Service.—Numerous business concerns employ foresters. Among these are: Lumber companies; pulp and paper corporations; public service concerns—power companies, railroads, water companies; mining corporations; naval stores companies; and individual forest and estate owners.

Most of these concerns want men with experience. Often men transfer from public to private service jobs. Usually beginning salaries with business and industry are lower than is the case with public employment; but the top salaries paid by corporations are, as a rule, much higher than those provided in the government salary scale.

Logging and Lumbering.—Forest jobs in lumbering and related occupations provide employment for more than 300,000 workers. For the most part, these

occupations are carried on in the South and West. The work is strenuous, yet has a strange and fascinating appeal. Foresters and those engaged in logging and lumbering make possible the work of 1,500,000 others who are engaged in woodworking and forest-products industries.

U. S. Forest Service

FOREST FIRE FIGHTERS TAKE TO THE AIR

Among jobs in logging are those of *fitters*, who mark trees for cutting; *axmen*, who cut down the trees; *toppers*, who, in the West, cut off tops of trees before they are felled to prevent loss from splitting; *scalers*, who estimate the lumber in logs; and *skidders*, who build skid roads.

Lumbering workers include *jack feeders*, who feed logs to the mills; *deck men*, who receive the logs for sawing; *sawyers*, who operate the saws; *filers*, who keep the saws sharp; and *graders*, who classify the lumber.

Some of these are skilled jobs that pay well. Among the jobs listed, the highest wages go to the toppers, sawyers, and filers.

The Future Outlook.—As we come into a greater knowledge and appreciation of possibilities, the number of forest workers should increase rather than diminish. The forest, for example, is the source of naval stores in which America leads the world. Through this industry we secure rosin and turpentine from the pine trees of the South. From the forest we get the pulpwood to make paper. For many years we bought our paper from other countries, but there is no reason why it might not be made at home and thus provide employment for thousands of our people. We get sugar and syrup from the forest and we grow trees from which we can soon get tung oil, a product which we now buy from foreign nations. Already we know that the cellulose from wood is used in making rayon, and we are discovering that many chemical products required in industry may be made from trees. But popular interest centers in forestry as a means of improving recreation facilities. We are all interested in log cabins and friendly trails; in beautiful streams and lakes teeming with fish; in wild retreats that harbor big game; and in all those things that are so essential to a delightful and stimulating vacation.

SUGGESTIONS FOR STUDY

Questions and Problems

1. In the Eastern Highlands, where Pisgah National Forest is located, why do plants grow so big and look so green?
2. In a general way, what is the nature of the work done by professional foresters?
3. Into what six groups or divisions may work with forests, so far as professional foresters are concerned, be divided?

4. Give examples of the kinds of work done under each of the listed activities of foresters.
5. What other kinds of work may foresters do? Give one or two examples.
6. Discuss the working conditions in forestry.
7. What are the advantages of forest occupations? The disadvantages?
8. What are the personal qualifications that forest workers should have?
9. What training must professional foresters have?
10. When were the first forest schools established in the United States?
11. How many forest schools are now maintained? Can you name any of these schools?
12. How long does it take to complete a college course in forestry? What special requirements are included in the training program?
13. How may employment opportunities in forestry be classified?
14. List the agencies of the Federal government that employ foresters.
15. List the state and local agencies that employ foresters.
16. List the kinds of private employers who require the services of foresters.
17. Discuss the advantages and disadvantages of public as compared with private service.
18. What salaries may professional foresters expect to earn?
19. What are some of the typical jobs in logging and lumbering?
20. How do the number of jobs in logging and lumbering compare with the number for professional foresters?
21. Explain how foresters, loggers, and lumbermen create jobs for others.
22. What are some of the jobs created by foresters, loggers, and lumbermen?

23. What is the outlook for forestry occupations?
24. What changes will tend to increase the number of jobs? Are there factors which will tend to decrease the work opportunities?
25. Would you like forestry work? Give reasons for your answer.

Selected References

Books

Read, Arthur D., The Profession of Forestry, The Macmillan Co., New York, N. Y.

Elliott, Charles N., Conservation of American Resources, Turner E. Smith & Co., Atlanta, Ga.

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Careers in Forestry, U. S. Department of Agriculture, Miscellaneous Publication No. 249, Washington, D. C.

Suggested Activities

1. Make a list of all the advantages of forest occupations. Make a list of all disadvantages of such occupations.
2. Collect all the pictures you can find dealing with forestry work. Arrange these on a poster with an appropriate title.
3. Write to one or more *Schools of Forestry* and ask for their bulletins or catalogues and other information dealing with forestry occupations and the qualifications for entering upon the work of each.
4. If possible, arrange for a forester to visit your school and talk about his work. If this is not possible, then write a letter to some forester enclosing a few well-selected questions about the profession.
5. Find out, through your state forest service, how many foresters are employed in your state and the type of work each is doing.
6. Prepare a short paper on the subject: *Occupations in Forestry.*

GLOSSARY

A

Afforestation—The act of creating forests.

Alidade—An instrument equipped with sights used to determine a line, or locate a point, such as a forest fire.

Annual Ring—A ring of wood put on each year by a growing tree; that is, the line indicating the growth for the period of one year. From the annual rings the age of the tree may be determined.

Apron—A flat metal strip inserted in a tree just above the cup to direct the flow of gum into the cup. This is a term, of course, which is used in connection with the naval stores industry.

Artificial Reproduction—Regeneration of forests by methods other than natural.

B

Back Fire—A fire started some distance before and directed against a fire to be fought, so that when the two fires meet, both go out.

Ball Planting—A process of planting trees that have been lifted with a ball of original earth retained on the roots.

Band Saw—A saw composed of a band of steel, with teeth on either edge, which runs on pulleys like a belt.

Bed A Tree—To pile brush on the ground where a tree which is being cut is to fall. The brush cushions the fall so that the trunk of the tree does not break.

Binder Chain—A chain used to tie logs on truck or wagon, or to build logs together in a raft.

Blaze—A mark made on a tree by hewing off some of the bark.

Blue Stain—A bluish or grayish discoloration of wood caused by the growth of certain mold-like fungi on the surface and the interior of the wood; produced by the same conditions that favor the growth of other fungi.

B. M.—Abbreviation for "board measure," meaning board feet.

Board Foot—A unit of timber measure equal to a piece of board a foot square and 1 inch thick.

Board Rule—A table giving the board-foot contents of boards of different dimensions.

Bolts—Small logs or sections of larger logs that have been split. A bolt is usually less than 4½ feet long.

Box—A cavity cut in the base of a tree to catch gum. Cups are now used almost universally in place of boxes.

Breast High—Four and a half feet high; the point on a tree where diameter measurements are taken.

Broadleaf Tree—A tree having leaves with broad surfaces (not needles).

Buck—To saw or chop a tree into logs.

C

Caliper—An instrument, consisting of a scale with one rigid and one movable arm, for measuring the diameters of trees.

Cambium—The layer of tissue just beneath the bark of the tree from which the new wood and bark cells of each year's growth develop. On the inner side of the cambium the typical wood cells, springwood and summerwood are formed. On the outer side of the cambium the phloem or bast is formed. While new phloem is being formed, corky cells which subsequently become the main portion of the bark are being formed in the older phloem.

Canopy—The leafy crown of trees.

Casehardening—A state of compression in the outer layers of a board or timber accompanied by tension in the center or core, the result of too severe drying conditions.

Catface—A scar on a tree resulting from an old wound or burn.

Cell—A term applied in general sense to the minute units of wood structure, including wood fibers, vessel segments, and other elements of diverse structures and functions.

Cellulose—The carbohydrate ($C_6H_{10}O$) that is the principal constituent of wood and of parts of many plants. Cotton fabric, paper, and rayon are common forms of manufactured cellulose.

Check Dam—A small dam made of stones, logs, or earth, used to check water flow and erosion.

Chip—(Noun) The wood removed by chipping. (Verb) To cut a streak or wound a tree for the purpose of allowing the resin to flow.

Circle Saw—A common power saw, with teeth on a steel disk, which turns on an axle.

Clinometer—An instrument for measuring vertical angles or slopes.

Closed Crown—A full, close, forest canopy which excludes sunlight.

Compression Wood—Abnormal wood formed on the lower side of branches and leaning trunks of softwood trees. Compression wood is identified by its relatively wide rings, usually eccentric, and its relatively large amount of summerwood, usually 50 per cent or more of the width of the annual rings in which it occurs. Compression wood shrinks excessively and irregularly lengthwise. It breaks with a more or less brittle or brash failure.

Conifer—A tree bearing seed cones; usually, an evergreen. A softwood. See *Gymnosperms*.

Contour Planting—Planting so that the rows "run around" the hill or slope on the same level, rather than up and down.

Cooperage—Wood from which barrels and kegs are made.

Core—A slender cylinder of wood taken from a tree by an increment

borer. Growth rings are counted on such cores to determine rate of tree growth.

Crop—(1) 10,000 turpentine faces. (2) The total annual production of naval stores for the entire industry.

Crotch—The fork of a tree or branch.

Crown—The expanse of branches and twigs of a tree; the tree top.

Crown Fire—A forest fire which extends to and sweeps along in the tops and branches of trees.

Cup—(Noun) A metal, clay, or other container hung on or below the turpentine face of a tree to accumulate the flow of gum. (Verb) To place cups on trees.

Cutting Area—A section of woodland upon which timber is being cut or will be cut.

D

D. B. H.—Diameter at breast height, which is 4½ feet above the ground.

Deadhead—A tree with a dead top.

Deciduous—Term applied to trees which drop their leaves in the fall.

Decimal Scale—A log scale graduated and marked in tenths of board feet.

Deck—A platform upon which logs are placed before being rolled on the saw carriage; a loading platform.

Dendrometer—An instrument for measuring tree growth.

Diameter Tape—A tape, based on relationship of circumference to diameter, for measuring the diameters of trees directly.

D. I. B.—Abbreviation for "diameter inside the bark."

Dibble—A tool used in planting tree seedlings.

Dinkey—A small logging locomotive.

Dip—(Noun) The name given to gum which collects in the cups. This distinguishes it from scrape which is gum that has hardened on the turpentine face. (Verb) To gather the gum from the cups to be taken to the stills.

Dominant Trees—Those in the forest that are tallest, largest, and most valuable.

E

Edge-Grain—Vertical-grain (Edge-Grain, rift-grain, comb-grain, or quarter-sawed) lumber is that which has been sawed so that the wide surfaces extend approximately at right angles to the annual layers or rings of growth. Material is considered vertical grain when the rings (so-called grain) form an angle of 45 to 90 degrees with the wide surface of the piece.

Entomology—That branch of biology which treats of insects.

Erosion—The mechanical moving of soil (1) by water; (2) by wind.

F

Face—(Noun) The total scarred surface of a turpentine tree formed by the cutting of successive streaks. (Verb) To slab off the bark and wood in preparation for setting the aprons and gutters.

False Ring—An extra zone of growth in a cross section of wood produced by a cessation or decided retardation of growth followed by resumption of growth within a single season. It can result from defoliation and releafing of the tree or temporarily unfavorable conditions of moisture, temperature, or other growth factors.

Fire Lane or Break—A strip in the forest kept clear of inflammable material as protection against spread of forest fire.

Fireproofing—Making wood resistant to fire. Wood cannot be treated chemically so that it will not char or decompose at 280 degrees Centigrade. What effective fireproofing does is to make wood difficult to ignite and keep it from supporting its own combustion.

First Growth—Timber stands in which no cutting has been done. Synonyms: Old growth timber, virgin timber.

Flume—A continuous trough of running water for floating logs or timbers.

Forest Floor—The covering of the mineral soil of a forest—humus, duff, and litter under forest growth.

Fungus—A plant which derives its nourishment from the organic matter of other plants.

G

Germination—The sprouting of a seed.

Girdle—To strip the bark from around trees.

Grabs—Hooks that grip logs; used in snaking and hauling.

Ground Fire—A forest fire which consumes humus and duff beneath the surface.

Gum—See Resin.

Gun Stick—An instrument used in felling trees to determine the direction of fall.

Gutter—A V-shaped metal strip inserted above the cup to direct the flow of resin into the container.

Gymnosperms—The botanical name for the group of plants that includes the so-called softwoods; literally the word means "seeds not enclosed." Terms commonly applied to trees belonging to the gymnosperm group: softwoods, evergreens, nonporous wood, needle- or scale-leaved trees, conifers. Most, but not all, true gymnosperms are needle-leaved, evergreen, and cone-bearing.

H

Hand Level—A small leveling instrument which is held in the hand while in use rather than being mounted on a tripod.

Hardwood—(1) Trees of the Broadleaf species. (2) Wood of broadleaf trees.

Heartwood—The wood in the interior of the tree, extending from the pith to the sapwood, in which the cells no longer participate in the life processes of the tree. Heartwood serves chiefly the mechanical function of support. Heartwood may be infiltrated with gums, resins, and other materials which usually make it darker and more decay resistant than sapwood.

Heeled In—Trees or plants covered with moist earth in a shallow trench or ditch.

Humus—Decayed vegetable matter; black soil rich in vegetable matter.

I

Increment—The growth of trees.

Increment Borer—An instrument for measuring the growth of trees.

K

Kiln—A drying chamber for seasoning lumber.

Kiln-Dry—Lumber seasoned in a kiln.

L

Laminated Wood—Wood built up of piles or laminae glued together or joined by nails, bolts, or other mechanical fastenings. The term is most frequently applied in cases where the plies are too thick to be classified as veneer, and where the grain of all plies is parallel.

Landing—A "yard" where logs are collected; usually beside a road, railroad, or river.

Layering—A process of reproducing trees by burying shoots so that they will sprout.

Legume Family—Plants that bear seeds in pods and have the ability to gather nitrogen from the air and store it in nodules on the roots of the plant.

Lifting—Taking up seedlings or transplants as in nursery practice.

Lignin—The second most abundant constituent of wood, located principally in the middle lamella. Lignin constitutes 20 to 35 per cent, by weight, of wood. Its chemical composition has not been definitely determined. Lignin may be isolated by treating wood with 72 per cent sulphuric acid to remove the cellulose associated with it.

Litter—Leaves, twigs, rotting wood, and duff beneath trees.

Loam—Loose, sandy soil rich in plant food.

Log—To cut and remove logs from an area.

Logger—(1) A man who is engaged in logging operations. (2) Locally, a man who hauls logs to landings or skidways.

Log Rule—(1) A table indicating the amount of lumber which can be sawed from logs of given sizes. (2) A log scaling stick.

Log Scale—A scaling stick for measuring the contents of logs in board feet.

Lumber Jack—One who works on logging operations.

M

Mammals—Animals which suckle their young.

M. B. M.—Abbreviation for "thousand board feet."

Mensuration—The science of measuring forest products.

Mother Tree—A picturesque name for seed trees left on logging operations.

Mulch—Material such as straw, leaves, or burlap placed on the soil for protection.

N

Natural Reforestation—The restocking of forests through "Mother Trees" or seed trees.

Naval Stores—A term applied to turpentine and rosin.

Notch—To cut a notch in a tree before sawing, to prevent splitting and binding, and to control the direction of fall.

O

Operator—A producer of naval stores.

Osmosis—The passing of liquid through a membrane, which, in the case of plants, means the passing of plant food from cell to cell.

P

Pathology—That branch of science which deals with diseases.

Peak—The sharp point of wood at the middle of the top of a turpentine face. It is formed by two streaks sloping downward toward each other.

Photosynthesis—The process of plant growth which takes place in the presence of sunlight.

Pistil—The female part of the flower which receives the pollen.

Pitch—The resin of a coniferous tree or a thick tar made from it.

Planting—Setting out seedlings or transplants.

Planting Bar—A bar used for making a hole for planting trees.

Plywood—Boards made from three or more thin layers of wood glued together.

Pollen—The "life giving" cells produced by the male parts of the flower.

Porous Woods—Another name for the hardwoods, which frequently have vessels or pores large enough to be readily seen under magnification.

Predator—An animal which preys upon other animals. Insects which prey upon other insects.

Puddling—The soaking of plant roots in a soupy mud.

Q

Quarter Sawed—Lumber which has been sawed radially rather than across the grain.

R

Reforestation—The propagation of trees by (1) the natural and (2) artificial means.

Resin—A sticky, oily substance extracted from several species of pines. It is also known by two other names—gum and oleoresin.

Root Hairs—Tiny feed roots which absorb water and plant food.

Rosin—That portion of crude gum which remains after the gum has been cooked and the turpentine and water has been removed by distillation.

Rotary-Cut Veneer—Veneer cut in a continuous strip by rotating a log against the edge of a knife in a special type of lathe.

Round Tree—A tree in which no turpentine face has been cut.

Run-off—Rain (or snow) water which runs off the surface rather than being absorbed by the earth.

S

Sanctuary—A protected place for wildlife; especially applied to bird protection.

Sander—A device for spreading sand over seeds in nursery beds.

Sapling—A young tree 2 to 5 inches in diameter.

Sapwood—That section of wood in a tree lying directly inside the cambium. It is usually lighter in color than the heartwood and is composed of living cells.

Scale—(1) To measure logs with a scaling stick. (2) The measured contents of logs. (3) A measuring instrument (scale stick) used to measure the board-foot contents of a log.

Scrape—Hardened gum that has formed on a turpentine face. This name distinguishes it from the gum which runs into the cup known as dip.

Second-Growth—Denotes timber that has grown after the removal of all or a large portion of the previous stand whether by cutting, fire, wind, or other agency. Typical second-growth conditions may come about in a forest that is untouched so far as lumbering operations are concerned. Second-growth material is frequently of rapid growth during its early life.

Seed Tree—A tree left after a cutting operation to supply seed for reproduction.

Shelterbelt—A continuous strip of trees grown primarily for protection against wind.

Shrub—A woody plant not attaining tree size or form.

Silting—The process by which silt and eroded soil is deposited by flood waters, as in river beds and reservoirs.

Silvics—Science of the growth and habits of forest trees.

Silviculture—The art of producing and managing forests.

Slash—(1) Waste from a sawmill; (2) a species of pine.

Sliced Veneer—Veneer which is literally sliced off the log or bolt by moving the log or flitch against a large knife.

Soda Process—An alkaline pulping process involving the use of an aqueous solution of sodium hydroxide, used in the production of book, magazine, and lithograph pulps, principally from hardwoods. The paper produced by the soda process is normally soft, bulky, opaque, and easily bleached and loaded. The yield is in the neighborhood of 40 per cent based on the oven-dry weight of chips admitted to the digester.

Spore—A minute reproductive organism produced by a flowerless plant.

Spud—A tool for removing bark from logs or trees.

Stratify—To store seeds by alternating layers of them with layers of sand or earth.

Streak—A wound formed when a tree is chipped.

Strip Survey—Estimating timber by strips running through the stand.

Stumpage—Standing timber, or the value of timber as it stands. Stumpage is often estimated by the acre or thousand board feet.

Sulphate Process—An alkaline pulping process, involving the use of caustic soda and sodium sulphide (the latter derived from salt cake or sodium sulphate by a smelting process), used in the production of wrapping papers and container boards from both hardwoods and softwoods (mostly softwoods). The paper produced by the sulphate process is tough and difficult to bleach. The yield is about 50 per cent on the basis of the oven-dry weight of chips admitted to the digester.

Suppressed Trees—Those "runts" not able to get the required sunlight and plant food.

Sustained Yield—Continuous yield of forest products on a given area.

Sustained Yield Basis—A plan or system of forest management which provides for cutting each year from the forest the same amount which is grown on the same tract so that the forest may be used permanently.

T

Tanbark—Bark, such as oak or hemlock, containing tannic acid in commercial quantities; used in tanning leather.

Thinning—Removing inferior trees from a stand to provide for better development of crop trees.

Timber—Standing trees; woodlands; lumber; any piece or pieces of wood of considerable size; a principal beam in a ship's framing.

Tins—The gutters or aprons made of sheet metal or other material used to aid in conducting the crude gum from a face into a cup.

Transplant—A young tree that has been lifted from a nursery bed and reset; to reset seedlings.

T. S. I.—Abbreviation for "timber stand improvement."

Turpentine—A volatile oil often called spirits. It is one of the main products derived from resin or gum in the process of distillation.

Turpentining—The process of working trees to obtain resin or gum. The term may also include the distillation process.

V

Veneer—A thin layer of wood glued over other wood of poorer appearance or quality.

Veteran—A tree having a diameter greater than 2 feet.

Virgin Forest—A forest which has not been cut over. Old growth.

W

Watershed—A drainage area; an area from which the run-off flows into a given stream.

Weathering—The mechanical and chemical disintegration and discoloration of the surface of wood due to exposure to light and to the alternate shrinking and swelling of the surface fibers with continual changes in moisture content due to weather changes.

Weed Trees—Undesirable species.

Wolf Trees—Those with abnormally large top-heavy limbs.

Wood Preservative—A substance applied to or injected into wood to protect it from attack of fungi, insects, or marine animals.

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